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EN12TCF048

Fish Passage Assessments - Lower Fraser Watershed Group

Prepared for:

British Columbia Timber Sales

Strait of Georgia Business Area

370 South Dogwood Street

Campbell River, BC

V9W 6Y7

Prepared by:

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March 2012

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March 30, 2012

British Columbia Timber Sales
Strait of Georgia Business Area
370 South Dogwood Street
Campbell River, BC V9W 6Y7

Attention: ***Dave Hamilton***

Re: EN12TCF048 Fish Passage Assessments – Lower Fraser Watershed Group

The following report details the results of fish passage assessments within watersheds in the Chilliwack Forest District conducted in the fall of 2011 on behalf of BCTS.

If you have any comments or questions, please do not hesitate to contact us.

Sincerely,

Allan Irvine, Environmental Technologist

Ico deZwart, Ph.D., R.P.Bio.

Reviewed by:

Sylvie Masse, M.Sc., R.P.Bio.
Masse Environmental Consultants Ltd.

EXECUTIVE SUMMARY

An assessment of stream crossings within a number of watersheds in the Lower Fraser River area was conducted for British Columbia Timber Sales in the fall of 2011. Watersheds included: Alouette River, Blaney Creek, Cascade Creek, Coquitlam River, Hatzic Slough, Kanaka Creek, Katzie Slough, Lagace Creek, Lost Creek, Pitt River, North Alouette River, Stave Lake Reservoir, and Widgeon Creek. Additionally, the "North Fraser River" area was included in the study to fill in the areas not included in the other watershed polygons (streams draining into the Fraser River between the Katzie Slough, Kanaka Creek, Stave River and Hatzic Slough watersheds). All areas are located within the Chilliwack Forest District.

A total of 1803 crossings were identified in the project area by GIS analysis. A total of 543 of these crossings were eliminated from the study as they were located on stream segments modeled as being high gradient (>25%) leaving a total of 1260 crossings modeled as fish bearing or potentially fish bearing. In the field, an additional 103 crossings were encountered and surveyed. A large number of crossings (835) were not assessed in the field due a number of factors including confirmed non-fish bearing status (from fisheries reports and management plans), high gradients observed in the field, absence of crossings in the field, GIS duplicates of other surveyed crossings, and access issues. Access to crossings was often not possible due to private land; boat access only areas; protected watershed areas; and gated roads controlled by various municipalities and agencies. In total, 528 crossings were surveyed within the study area. Of these, 352 were closed bottom structures, 165 were open bottom structures, and 11 crossings were fords.

Crossings identified as potential barriers to fish passage were ranked by high, moderate or low priority for further action. Crossings were initially prioritized by habitat value and cost benefit ratio to provide an initial ranking. These rankings were subsequently adjusted by reviewing additional information obtained from a variety of sources, such as fisheries reports and management plans. Information taken into account included length of habitat gained, species of fish, existing fish distribution, passability of the existing structures to adult salmonid species, gradient, availability of fisheries information, and the presence/location of natural and anthropogenic barriers. In total nine crossing were rated as high priority and 23 crossings were rated as moderate priority for further action.

Follow up studies in areas of these watersheds not surveyed in this study will require boat assisted access as well as extensive planning to arrange admittance to municipal watershed areas as well as private, park, and institutionally managed lands.

The urban and residential locale of many of these impacted streams provides a setting potentially conducive to restoration efforts. The high population densities present in many of the surveyed watersheds could present opportunities for partnerships between a variety of stakeholders including local restoration and stewardship groups, educational institutions and municipal governments among others.

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1 INTRODUCTION

Masse Environmental Consultants Ltd. was retained by British Columbia Timber Sales (BCTS) - Strait of Georgia Business Area in the fall of 2011 to conduct an assessment of stream crossings within a number of watersheds within their chart area. This project was funded through the Land Based Investment Program (LBIP). Hillcrest Geographics was subcontracted for the GIS component of the project and HiMark Forest Consultants Ltd was subcontracted for the engineering component which includes recommendations for restoration options and cost estimates related to the replacement and remediation of crossings.

The work was carried out in accordance with the following standards:

- General FIA Standards (FS 1001).
- BC Ministry of Environment "The Strategic Approach: Protocol for Planning and Prioritizing Culverted Sites for Fish Passage Assessment and Remediation": 3rd Edition, March 2009 (MoE 2009).
- BC Ministry of Environment "Field Assessment for Determining Fish Passage Status of Closed Bottom Structures", 4th Edition, August, 2011 (MoE 2011).

Road crossings, especially culverts, may impede fish movement for both migratory and resident fish populations. The main objective of this study was to identify stream crossings that are potential barriers to fish passage and provide recommendations for rehabilitation by either improving fish passage or removing and replacing the culvert.

1.1 Project Location

Thirteen priority watersheds were identified on the north side of the Lower Fraser River by BCTS in consultation with the Ministry of Environment (MoE) for inclusion in the study area (Table 1). In addition, several streams located between these watersheds were included in the study and grouped under the title "North Fraser" watershed. All areas are located within the Chilliwack Forest District. An overview map provides the location of each watershed (Figure 1).

Table 1. Description of study area.

Watershed	Description
Alouette River	Flows in a south-westerly direction through the Alouette Reservoir to Maple Ridge. The river then flows in a predominantly western direction through Maple Ridge and flows into the Pitt River 6 km north of the Fraser River.
Blaney Creek	Flows south from Loon Lake to a wetland area located approximately 5 km north of Maple Ridge then flows west into the North Alouette River approximately 5 km from the Pitt River.
Cascade Creek	Flows in a western direction into the Stave Lake Reservoir approximately 15 km north of Mission.
Coquitlam River	Flows south from Coquitlam Lake Reservoir through the City of Coquitlam into the Fraser River approximately 3 km west of the mouth of the Pitt River.
Hatzic Slough	Flows in a southern direction into the Fraser River just east of Mission.
Kanaka Creek	Flows in a south-westerly direction into the Fraser River immediately south of Maple Ridge.
Katzie Slough	Flows in an easterly direction through low lying agricultural areas immediately north of Pitt Meadows into the Pitt River approximately 3 km north of the confluence with the Fraser River.
Lagace Creek	Flows in a primarily southern direction into Hatzic Lake approximately 7 km north of Mission.
Lost Creek	Flows in a south-westerly direction into the Stave Lake Reservoir approximately 20 km north of Mission.
North Alouette River	Flows in a south-westerly direction to Maple Ridge then flows in a predominantly western direction then joins the Alouette River before flowing into the Pitt River 6 km north of the Fraser River.
North Fraser	These areas encompass streams that flow directly into the Fraser River from the north that were not included in the previously detailed watershed polygons. Stream areas were located between three small polygons located between the Katzie Slough watershed to the west and Hatzic Slough watershed on the east side.
Pitt River	Flows in a south-westerly direction from Pitt Lake into the Fraser River on the south-east edge of Coquitlam.
Stave Lake Reservoir	Flows in a southern direction through Hayward Lake into the Fraser River approximately 9 km west of Mission.
Widgeon Creek	Flows south through Pinecone Burke Provincial Park into the Fox Reach of the Pitt River 18 km north-east of the confluence of the Pitt River and the Fraser River.

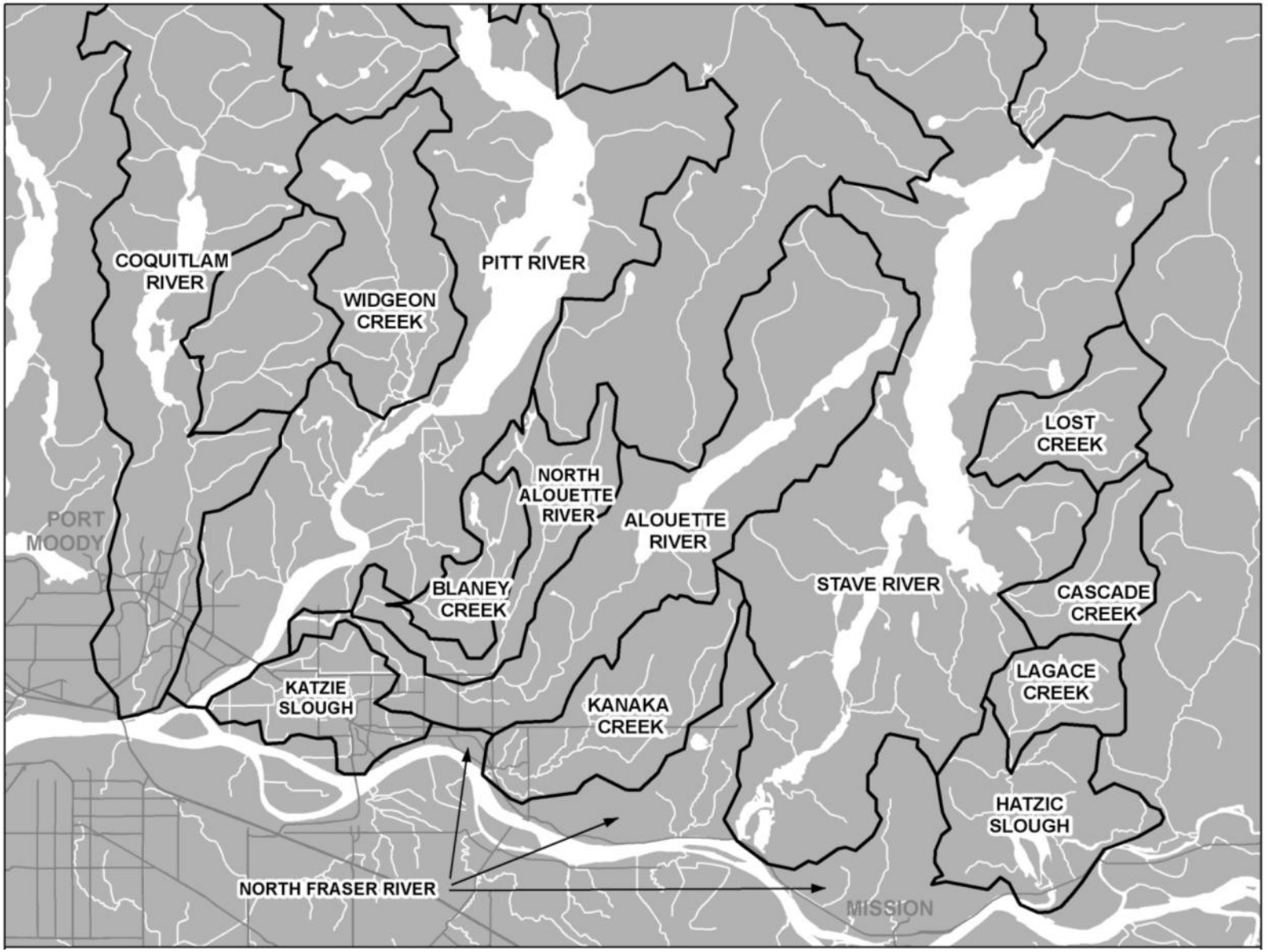

Figure 1. Overview map of study area.

1.2 Fisheries Background

The following table provides a summary of fish species present in each watershed.

Table 2. Summary of fish species present by watershed (FISS).

Watershed Name	Fish Species[1]
Alouette River	ABT,ACT,BMC,BNH,BSB,BT,CC,CH,CM,CO,CP,CSU,CT, DV,KO,L,LNC,LSU,LT,MW,NSC,PCC,PK,RB,RSC,SB,SK,ST,STC,SU,TSB
Blaney Creek	CM,CO,CT,ST,TR
Cascade Creek	CAL,CAS,CT,DV,KO,RB
Coquitlam River	ACT,CAS,CC,CH,CM,CO,CT,DC,DV,EB,PK,RB,RSC,SST,ST,TSB,WF,WST
Hatzic Slough	BCB,BH,BNH,BSB,CAS,CH,CM,CO,CP,CSU,CT,DV,NSC,PCC,PK,RB,SG,ST,SU,TSB,WCT
Kanaka Creek	ACT,CC,CM,CO,CT,PK,RB,SB,ST,WCT
Katzie Slough	BCB,BH,BNH,CC,CO,CP,SU
Lagace Creek	ACT,CC,CM,CO,CT,L,RB,SB,ST,TSB
Lost Creek	CT,DV,KO,RB
North Alouette River	CM,CO,CT,RB,ST
North Fraser	ACT,BCB,BMC,BB,BNH,BSU,BT,C,CAL,CAS,CBC,CC,CCG,CCT,CH,CLA,CM,CMC,CO,CP,CSU,CT,DV,EU,ESC,GSG,L,LDC,LKC,LNC,LSM,LSU,NSC,MSU,MW,NSC,RSC,PCC,PK,PL,PW,RB,RSC,RL,SA,SB,SFL,SFL,,SH,SK,SSM,ST,SU,STC,TSB,WCT,WSG,WSU
Pitt River	BCB,BKH,BMC,BB,BNH,BT,C,CAL,CAS,CC,CH,CM,CO,CP,CSU,CT,DV,EU,L,LSU,MW,NSC,RSC,PCC,PK,PL,RB,RSC,SFL,SG,SK,SP,SSM,ST,TSB
Stave River	SH, BH, CM, CT, DV, CSU, NSC, RB, ST, UN, AS, CH, CO, ACT, KO, MW, PK, CC, SU
Widgeon Creek	CM,CO,CT,RB,SK,ST

[1]ABT: anadromous bull trout; ACT: anadromous cutthroat trout; AS: Atlantic salmon; BB: burbot; BCB: black crappie; BH: catfish (general), BMC: brassy minnow; BNH: brown catfish; BKH: black catfish; BSB: brook stickleback; BSU: bridgelip sucker; BT: bull trout; C: minnow(general); CAL: coastrange sculpin; CAS: prickly sculpin; CBC: chub (general); CC: sculpin (general); CCG: slimy sculpin; CCN: shorthead sculpin, CCG: slimy sculpin; CCT: coastal cutthroat trout CH: chinook salmon; CMC: chiselmouth; CO: coho salmon; CLA: staghorn sculpin CP: carp; CM: chum salmon, CRH: torrent sculpin; CSU: large scale sucker; CT: cutthroat (general), DC: dace (general), DV: dolly varden; EB: eastern brook trout; EST: emerald shiner; EU: eulachon, GSG: green sturgeon KO: kokanee; L: lamprey (general); LDC: leopard dace LKC: lake chub, LNC: longnose dace; LSM: longfin smelt, LSU: longnose sucker, LT: pygmy longfin smelt, MSU: northern mountain sucker MW: mountain whitefish; NSC: northern pike minnow; PCC: peamouth chub; PK: pink salmon; PL: Pacific lamprey, PW: pygmy whitefish RB: rainbow trout; RSC: redside shiner; RL: river lamprey, SA: salmon (general), SB: stickleback (general); SFL: starry flounder, SG: sturgeon (general); SH: American shad, SK: sockeye salmon, SSM: surf smelt, SST: steelhead (summer-run), ST: steelhead, STC: spottail shiner, SU: sucker (general), TR: Unidentifiable Trout - only fry <70mm in length; TSB: threespine stickleback; WCT: westslope cutthroat trout; WF: whitefish (general) WSG: white sturgeon; WSU: white sucker; WST: steelhead (winter-run) SP: unidentified species

2 METHODOLOGY

The Ministry of Environment has developed a five step methodology in order to conduct a systematic assessment of closed bottom structures and to prioritize areas based on the highest fisheries values. The five phases outlined in the Fish Passage Protocol for Culverted Sites (MoE 2009) are:

1. Planning Phase
2. Data Collection Phase
3. Analysis Phase
4. Implementation Phase
5. Reporting Phase

The scope of this project includes the first three phases. Detailed design of culvert replacement options identified during the first 3 phases will be developed during the implementation phase. This report provides a detailed descriptions of the stream crossings assessed and recommendations to improve fish passage.

2.1 Planning Phase

The planning phase consists of prioritizing watersheds on a regional basis to conduct fish passage assessments (MoE 2009). This phase was completed by BCTS in consultation with MoE.

Once the contract was awarded, Hillcrest Geographics was subcontracted to develop detailed maps of the project area identifying all crossings of roads and 1:50,000 scale trim streams. Known fisheries information was then added along with modeled stream segment gradients. The Fisheries Inventory Summary System (FISS) known fish observations layer and provincial obstacles to fish passage layer were used in the modeling. Lengths of stream located downstream of any known fish observation point were considered fish bearing. Above a fish observation, the stream was modeled as fish bearing until an obstacle to fish passage was observed or an average gradient of the stream segment was more than 25%. Stream segments were sections of stream grouped together into lengths of similar gradient. Segments of stream with average slope greater than 25% were considered non fish bearing upstream from the downstream end of the segment. Stream segments with gradients <25% and no available fisheries information were classified as inferred fish bearing. In addition to the GIS modeling, fisheries maps (at a scale of 1:20,000) were obtained, literature was reviewed, and local knowledge of fisheries presence/absence were utilized to gather information on fish bearing stream reaches as well as non fish bearing reaches in preparation for field assessment.

2.2 Data Collection Phase

Each watershed was systematically approached to ensure that all crossings accessible were located. Additional crossings identified in the field were also assessed. As the study area was located in the lower mainland, field crews faced a number of access issues, including: private lands; boat access only areas; protected watershed areas; and gated roads controlled by various municipalities and institutions. When possible keys to gates were obtained from various stakeholders and access was requested from private land owners. However, large areas of many watersheds could not be accessed during this study.

Crossings on stream segments classified as non fish bearing were eliminated from the study and not visited in the field. Only fish bearing or potentially fish bearing crossings were surveyed and included closed bottom structures (CBS), open bottom structure (OBS) and crossings considered "other" (fords, weirs, etc.). Six digit numerical crossing identifiers were generated by GIS. Crossings identified in the field that had no corresponding GIS generated ID were given unique identifiers. Photos were taken at all surveyed crossings and when possible included a photo of the crossing inlet, crossing outlet, crossing barrel, channel downstream and channel upstream of the crossing and any relevant features.

Additionally, the following information was recorded for all surveyed crossings: date of inspection, crossing reference, crew member initials, UTM coordinates, stream name, road name and kilometer, road tenure information, crossing type, crossing subtype, culvert diameter or span for OBS, culvert length or width for OBS. A more detailed "full assessment" was completed for all closed bottom structures.

Full assessments also included the following parameters: presence/absence of continuous embedment (yes/no), average depth of embedment, whether or not the culvert bed resembled the native stream bed, presence of and percentage backwatering, fill depth, outlet drop, outlet pool depth, inlet drop, culvert slope, average downstream channel width, stream slope, presence/absence of beaver activity, presence/absence of fish at time of survey, type of valley fill, and a habitat value rating. For crossings determined to be potential barriers or barriers based on the data (see section 2.3.2) a culvert fix and recommended diameter/span was proposed. A fix was not proposed for some crossings determined to be potential barriers or barriers when remediation was not considered reasonable (lack of habitat upstream, steep gradients (>30%), crossing was passable based on professional judgment).

All field data collected including photos were uploaded to the Provincial Stream Crossing Inventory System (PSCIS).

2.3 Analysis Phase

The analysis phase was used to produce a priority ranking for site restoration and included the following steps (MoE 2009):

- Determine Habitat Gained Index (HGI)
- Conduct cost benefit analysis

These steps ensure that site selection and prioritization of restoration sites have the greatest benefit.

2.3.1 Habitat Gained Index (HGI)

The HGI consisted of measuring the length of stream (km) that may become accessible to fish by removing or replacing a culvert. Measurements were calculated by GIS or measured on 1:20,000 scale maps and included all habitat within the main stem and tributary streams with gradients less than 25%.

2.3.2 Determination of a Barrier

Fish passage potential was determined for each stream crossing identified as a close bottom structure. The following criteria, which act as hydraulic indices, were utilized to determine whether a crossing was a barrier to fish passage:

- Depth and degree of embedment
- Outlet drop
- Slope of culvert
- Stream width ratio (ratio of average downstream channel width to culvert width)

- Length of the culvert

Each criterion was scored according to the values provided in the MoE protocol (MoE 2011; Table 2), which were developed based on data obtained from various studies (Clarkin et al. 2008; Robison and Walsh 2008).

The individual criteria may not be sufficient to determine whether a culvert is a barrier to fish passage and their cumulative effect must be considered. The following thresholds, which have been derived from the summation of the scores for each criterion, were used to determine fish passage (MoE 2011; Table 3).

Table 3. Fish Barrier Scoring

Risk	Embedded	Value	Outlet Drop	Value	Slope	Value	SWR	Value	Length	Value
LOW	>30cm or >20% of diameter and continuous	0	<15	0	<1	0	<1.0	0	<15	0
MOD	<30cm or 20% of diameter but continuous	5	15-30	5	1-3	5	1.0-1.3	3	15-30	3
HIGH	No embedment or discontinuous	10	>30	10	>3	10	>1.3	6	>30	6

Table 4. Fish Barrier Result

Cumulative Score	Result
0-14	Passable
15-19	Potential Barrier
>20	Barrier

2.3.3 Cost Benefit Analysis

A cost benefit analysis of each crossing was then conducted in order to prioritize works to be completed. This assessment included an initial look at potential solutions, the HGI and local knowledge. Potential options to stream crossings that were assessed as fish barriers may include removal of the structure, replacing the culvert with a passable structure (open bottom structure such as a bridge or arch culvert), adding substrate to the culvert, or backwatering the structure to reduce velocity and turbulence. Additionally, the installation of baffles within existing structures was considered where appropriate. A common fix prescription included the installation of baffles, backwatering of the crossing *and* addition of substrate material. When any combination of baffle installation, backwatering and substrate addition was prescribed "additional substrate material" was listed as the crossing fix in the PSCIS submission form. The specifics of the fix were further explained in the assessment comment column of the spreadsheet.

Costing for remedial works was based on the category of choice for each structure. Costing for panel bridge and open bottom arch type structures was based on span and either crib height (bridges) or fill depth (open bottom arch types of structures). Pricing of structures was researched through a local bridge builder/installer and local distributers. Costs for backwatering or streambed simulation estimates were primarily experience based as the variability of streambed morphology combined with structure type and installation parameters was too high for standardized estimates. Rockwork was included for each size of structure as a percentage multiplier from a base cost. Pavement costs were based on a 2011 interview with the District of Mission Public Works Superintendent with costing expressed as cost per square meter. Four costs per lineal meter were developed for single lane, double lane, double lane with sidewalks and major highway. Professional costs were added to the structure costs by a generalized percentage allocation; 15% of structure estimate for Professional Engineer and 10% for an RP Bio. A "Factor of Difficulty" was applied to each structure located on rural residential (paved), urban residential (paved), major corridor street (paved) and major highway to consider costs associated with public works such as water lines and storm sewers, fill retention structures, sidewalks, street/traffic lighting, gas lines and other buried services. Cost benefit is expressed in kilometres of stream access restored per $1,000.00.

Crossings were initially prioritized by habitat value and cost benefit ratio to provide an initial ranking for prioritization. These rankings were subsequently adjusted by reviewing additional information obtained from a variety of sources, such as fisheries reports and management plans. Information taken into account included HGI, species of fish, existing fish distribution, passability of the existing structures to adult salmonid species, gradient, access issues, availability of fisheries information, and the presence/location of natural and anthropogenic barriers. Three prioritization categories were developed for crossing remediation or replacement (high priority, moderate priority and low priority).

Maps showing the locations of all crossings identified and their status are provided in Appendix 1. A digital summary file are also provided (Appendix 2) of all crossings identified in the watershed and their status (barrier, potential barrier, passable, no further assessment required, or not assessed). Also included in Appendix 2 is a geodatabase of the study data for GIS applications. This file also contains a comment field with further information for each crossing. A summary of the fish barrier scoring for assessed culverts is provided in Appendix 3. Field data and photographs for high and moderate priority crossings are included in Appendix 4. A summary of crossings identified as low priority for further actions is provided in Appendix 5. A summary of crossings identified as requiring no further action actions is provided in Appendix 6. Data and photographs all crossings assessed can be accessed through the PSCIS database.

3 RESULTS

A total of 1803 crossings were identified in the project area by GIS analysis (Table 5). A total of 543 of these crossings were eliminated from the study as they were located on stream segments modeled as being high gradient (>25%) leaving a total of 1260 crossings modeled as fish bearing or potentially fish bearing. In the field, an additional 103 crossings were encountered and surveyed. A large number of crossings (835) were not assessed in the field. As mentioned previously access to crossings was often not possible due to private land; boat access only areas; protected watershed areas; and gated roads controlled by various municipalities and agencies. Reasons why crossings were not assessed is discussed in more detail in subsequent sections of the report where each watershed is discussed individually. In total, 528 crossings were surveyed within the study area. Of these, 352 were CBS, 165 crossings were OBS, and 11 crossings were "other" (fords). Maps of the study area detailing all crossings identified and surveyed are included as Appendix 1.

Table 5. Summary of crossings identified, not assessed and surveyed within the study area.

Watershed	Crossings Identified					Not Assessed	Crossings Surveyed		
	GIS All	GIS Modeled Non-Fish	GIS Potential and Confirmed Fish	Additional Crossings Identified in Field	Total GIS Fish and Field		OBS / Other	CBS	Total Assessed
Alouette	117	27	90	9	**99**	45	7	47	**54**
Blaney	50	1	49	0	**49**	46	1	2	**3**
Cascade	98	91	7	0	**7**	5	1	1	**2**
Coquitlam	269	80	189	4	**193**	127	23	43	**66**
Hatzic	54	6	48	3	**51**	22	9	20	**29**
Kanaka	107	0	107	19	**126**	56	26	44	**70**
Katzie	41	0	41	10	**51**	28	8	15	**23**
Lagace	41	17	24	1	**25**	5	7	13	**20**
Lost	125	62	63		**63**	44	11	8	**19**
N. Alouette	42	1	41	3	**44**	32	6	6	**12**
N. Fraser	247	23	224	9	**233**	188	3	42	**45**
Pitt	101	10	91	31	**122**	57	31	34	**65**
Stave	419	189	230	13	**243**	133	40	70	**110**
Widgeon	92	36	56	1	**57**	47	3	7	**10**
Total	**1803**	**543**	**1260**	**103**	**1363**	**835**	**176**	**352**	**528**

Based on the fish barrier scoring tool (MoE 2011), 204 of the assessed culverts were determined to be barriers to fish passage, 60 were determined as potential barriers, and 88 were determined to be passable for fish (Appendix 3). Of the 264 assessed culverts that were identified as barriers or potential barriers to fish passage, 173 crossings underwent cost benefit analysis for prioritization. The remaining 91 crossings were eliminated at this stage as they did not warrant follow up action. Of these, 29 crossings were deemed passable although they scored as potential barriers or barriers. The remainder

were eliminated due to factors such as very low quality habitat, no HGI, proximity of barriers, and steep gradients.

3.1 Cost Benefit Analysis

Possible restoration options were developed for the 173 crossings that were identified as barriers or potential barriers and required further analysis. These are presented in this section with estimates of the cost of implementing each option. The costs were developed for each individual crossing and did not take into account potential cost savings by completing a number of crossings consecutively.

The following options were considered for restoration of crossings that were identified as impeding or potentially impeding fish passage:

- Backwatering (BW)
- Embedment (EM)
- Steel bridge (SB)
- Concrete bridge (CB)
- Streambed simulation (SS)
- Removal (RM)

These options, however, are preliminary in nature and detailed design will be developed during subsequent phases. All final designs will have to meet the requirements of the British Columbia Forest and Range Practices Act and Regulations. As many of the crossings requiring remediation are on urban roads, final designs will also have to meet applicable provincial or municipal requirements.

The 173 crossings were subsequently ranked as described in Section 2.3.3 to generate a list of priorities.

1. High Priority (Table 6) – 9 crossings.
2. Moderate Priority (Table 7) – 23 crossings.
3. Low Priority (Appendix 4) – 141 crossings.

Lists of all the assessed crossings that represent potential barriers to fish passage are presented by watershed in Tables 8 to 19. Priority crossings are highlighted in bold in the tables and are discussed in more detail in the description of each watershed assessed in Section 3.2. Only one out of 32 crossings rated as high and moderate priority for remediation or replacement was located on a forestry road. The remaining crossings were located on urban, rural, park or recreational roads.

Table 6. High Priority Crossings.

ID	Road Type	Watershed	Stream Name	UTM (10U)	Barrier Result	Habitat Value	Cost Benefit (km/$K)	HGI	Fix	Cost Est. ($K)	Species Present	Barrier d/s	Barrier u/s	Comments
545770	Urban	Coquitlam	Scott Ck	513782 5462074	Barrier	Medium	0.151	6.04	EM/BW	40	ACT,CCT,CH,CM,CO,CT,DC,L,RB,ST,SU	545835		Spawning, rearing and overwintering habitat upstream. Accessible to anadromous species.
545983	Unknown	Alouette	Mike Lake Ck	533991 5457845	Barrier	High	0.083	5.04	SB	61	CT,RB,SB,TSB	546061		Excellent habitat upstream. Would provide access to lake for anadromous species with 546061.
546366	Urban	Kanaka	Trib to Kanaka Ck	538136 5452691	Barrier	High	0.051	9.96	CB	197	CT	546440		Relatively high HGI. See also 546440.
546061	Park	Alouette	Mike Lake Ck	534343 5456242	Barrier	High	0.031	1.86	EM/BW	60	CT,RB,SB,TSB		Yes	Would provide access to lake for anadromous species with 545983.
546506	Urban	N. Fraser	Whonnock Ck	540543 5450466	Barrier	High	0.030	12.58	CB	413	ACT,CM,CO,CT,PK,ST	546738		Relatively high HGI. Anadromous species. See also 546738.
546722	Urban	N. Fraser	York Ck	538874 5447231	Barrier	High	0.028	1.67	EM/BW	60	CM,CO,CT	546740	Yes	Access to spawning habitat for anadromous species.
546440	Urban	Kanaka	Trib to Kanaka Ck	537429 5452053	Barrier	High	0.018	1.06	EM/BW	60	CT		Yes	Excellent habitat upstream. See also 546366.
546512	Urban	Hatzic	Kenworthy Ck	553494 5449754	Barrier	High	0.014	2.49	CB	175	AO,CC,CM,CO,CT,L			Access to spawning habitat for anadromous species.
546179	Urban	N. Alouette	Trib to N. Alouette River	531034 5454636	Barrier	High	0.012	2.89	SS	246				Possible access to spawning habitat for anadromous species.

Table 7. Moderate Priority Crossings.

ID	Road Type	Watershed	Stream Name	UTM (10U)	Barrier Result	Habitat Value	Cost Benefit (km/$K)	HGI	Fix	Cost Est. ($K)	Species Present	Barrier d/s	Barrier u/s	Comments
546334	Rural	Stave	Steelhead Creek	549753 5452359	Potential	High	0.201	6.04	EM/BW	30	CT,RB	546263	Yes	Likely passable to larger fish. Good habitat u/s and d/s. Candidate for substrate addition and backwatering.
302	Urban	Stave	Hairsine	546129 5448025	Potential	High	0.143	2.85	EM/BW	20	CT,RB	546600		May not be a barrier to larger fish. Candidate for internal works and backwatering.
546738	Urban	N. Fraser	Whonnock Cr	539351 5446972	Barrier	High	0.105	6.31	EM/BW	60	ACT,CM, CO,CT,PK,ST		Yes	Likely passable to most species of adult fish but works will improve passage.
546270	Urban	Stave	Steelhead Creek	549170 5453008	Barrier	High	0.078	1.96	EM/BW	25	CT,RB		Yes	Increase contiguous habitat. Will improve passage for all life stages.
546460	Urban	Hatzic	Trib to Hatzic Slough	556012 5450959	Potential	High	0.058	1.45	EM/BW	25	CC, CM			Spawning habitat for anadromous species upstream. Beaver dams currently provide backwatering.
546473	Urban	Hatzic	Trib to Hatzic Slough	556069 5450894	Potential	Medium	0.050	5.00	SS	99	CC, CM			Spawning habitat for anadromous species upstream. Beaver dams currently provide backwatering.
546227	Rural	Stave	Trib to Cardinalis Ck	552172 5453315	Barrier	Medium	0.049	1.23	EM/BW	25	RB,DV			Excellent habitat upstream for resident populations. Fish presence needs to be confirmed.

ID	Road Type	Watershed	Stream Name	UTM (10U)	Barrier Result	Habitat Value	Cost Benefit (km/$K)	HGI	Fix	Cost Est. ($K)	Species Present	Barrier d/s	Barrier u/s	Comments
546449	Rec	Stave	Trib to Hayward Reservoir	546053 5451583	Barrier	Medium	0.044	1.57	SS	36	CT,RB		Yes	Spawning habitat present and would be accessible to Hayward Reservoir. Fish presence needs to be confirmed.
546588	Urban	N. Fraser	Trib to Whonnock Ck	540938 5448867	Barrier	Medium	0.044	1.97	EM/BW	45	CM,CO, CT	546699		Anadromous fish species present historically. Crossings on private property should be assessed.
546427	Urban	Stave	Phillips Creek	543195 5451955	Barrier	High	0.042	1.05	EM/BW	25	CT		Yes	Provides spawning rearing habitat for Hayward Reservoir (see 546250).
546699	Urban	N. Fraser	Trib to Whonnock Ck	540559 5447549	Barrier	Medium	0.038	1.51	EM/BW	40	CM,CO, CT	546738	Yes	Passable for larger fish but will improve passage. Crossings on private property should be assessed.
546250	Urban	Stave	Phillips Ck	543369 5453401	Barrier	Medium	0.037	0.91	BW	25	CT	546303		Beaver activity upstream, abundant rearing habitat. Several private crossings downstream should be assessed (see 546427).
546351	Urban	Kanaka	Trib to Kanaka Ck	534835 5452902	Barrier	High	0.030	1.79	EM/BW	60	CT	546396	Yes	Excellent habitat upstream for resident population (see also 546435).
546882	Urban	N. Fraser	Jamieson Ck	543647 5445163	Barrier	High	0.024	0.18	BW	8			Yes	Likely passable but outlet control rockwork appears to be eroded or shifted. Accessible to Fraser River anadromous fish populations.

ID	Road Type	Watershed	Stream Name	UTM (10U)	Barrier Result	Habitat Value	Cost Benefit (km/$K)	HGI	Fix	Cost Est. ($K)	Species Present	Barrier d/s	Barrier u/s	Comments
546435	Urban	Kanaka	Trib to Kanaka Ck	535498 5452221	Barrier	High	0.021	1.80	EM/BW	85	CT			Excellent habitat upstream for resident population (see also 546351).
546516	Urban	Kanaka	Dunlop Ck	533338 5450534	Barrier	High	0.020	0.40	EM/BW	20	CM,CO, CT			Excellent habitat. Will improve access for anadromous species.
545835	Urban	Coquitlam	Scott Ck	513674 5461070	Barrier	High	0.018	1.16	EM/BW	65	ACT,CC T,CH,CM ,CO,CT, DC,L,RB, ST,SU		Yes	Likely passable to larger fish. Excellent habitat. Drop at outlet is barrier to small fish (see also 545770).
546600	Urban	Stave	Hairsine Ck	545489 5448631	Barrier	High	0.015	0.55	EM/BW	38	CT,RB		Yes	Will improve access for all life stages. Resident population present.
310	RP	Stave	Trib to Cardinalis Ck	550743 5455070	Barrier	Medium	0.014	0.90	SS	64	RB, DV			Access to spawning/rearing habitat for resident species. Non-trim stream. Fish presence needs to be confirmed.
546433	Urban	Kanaka	Kanaka Ck	539442 5452055	Barrier	High	0.014	1.20	EM/BW	85	CT		Yes	Access to habitat for resident populations
546314	Urban	Lagace	Oru Ck	555368 5453222	Barrier	High	0.009	1.53	CB	175	CM,CO			Anadromous species historically present upstream.
CV8	Urban	Pitt	Trib to Pitt River	523023 5463562	Barrier	High	0.003	0.10	SS	35				Excellent habitat. Access to spawning habitat for Pitt River anadromous species.
546478	Urban	Alouette	McKenny Ck	525815 5452042	Potential	Medium	0.017	0.43	BW	25	ACT,CC, CM,CO, CT,L,PK, RB,SB		Yes	Access to spawning habitat for anadromous species.

3.2 Watersheds Assessed

3.2.1 Alouette River

A total of 117 crossings were identified within the Alouette River watershed by GIS with 90 crossings identified as fish bearing or potentially fish bearing (Table 5). An additional nine crossings were identified in the field. Forty five of these crossings were not assessed for a number of different reasons. Fifteen crossings could not be located in the field mainly because urban development had significantly altered the landscape. Twelve crossings were not accessible as they were on private land or located within the University of British Columbia (UBC) Malcolm Knapp Research Forest not accessible to the public. The remaining crossings were not assessed due to high gradients precluding fish use, road washouts, and locked gates belonging to BC Hydro. In total, 54 crossings were surveyed with 47 full assessments of closed bottom structures and seven assessments of OBS and other crossings. Partnerships for restoration of structures within this area could potentially be forged with the Alouette River Management Society as they actively work on fish habitat restoration projects within the watershed. Other key stakeholders in the watershed include BC Hydro and the City of Maple Ridge. The following provides more information on the crossings deemed to be high or medium priority for follow up action.

Crossings 545983 and 546061 are located on the Mike Lake Creek within Golden Ears Park (Table 6). Rainbow trout (*Oncorhynchus mykiss*) and cutthroat trout (*O. clarki*) have been reported upstream in Mike Lake (T.G.N. 1951). At each crossing location, habitat value was rated as high with deep pools, abundant cover, large woody debris (LWD) and undercut banks present. Remediation of these two crossings could potentially open up 6.9 km of habitat, including the 10.3 acre Mike Lake (T.G.N. 1951), to anadromous salmon and trout species from the Alouette River. According to Adamah Consultants (2005), spawning habitat is present at Mike Lake which provides natural recruitment for the resident native coastal cutthroat population that occurs there. The cost estimate for remediating these two crossings is estimated at $121,000. The recommended crossing for 545983 is a steel bridge. Crossing 546061 could be remediated by adding substrate and internal baffles, along with an outlet weir and an inlet step. The cost benefit value for the two crossings combined is 0.079 km/$K. A habitat assessment upstream of the crossings is recommended to confirm access and habitat quality.

McKenny Creek is a tributary to the Alouette River that runs through highly urbanized and agricultural areas of Maple Ridge. Chum salmon (*O. keta*), coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), resident and anadromous cutthroat trout, rainbow trout, lamprey (*Lampetra sp.*), sculpin (*Cottus sp.*) and stickleback (*Gasterosteus sp.*) have been reported in the lower reaches of the stream (FISS). There were six crossings identified on the stream by GIS. The first four crossings located upstream of the Alouette River are not barriers to fish passage. However, the two upstream crossings (546478, 546485) are barriers. Relatively recent sampling of the stream near crossing 546478 (Triton Environmental Consultants 2008), utilizing dip netting, electrofishing and minnow trapping resulted in the capture of three spine stickleback (*G. aculeatus*). However, Davies (1996) reports coho salmon up to the Lougheed Highway. Crossing 546478 was rated as a moderate priority for restoration through substrate addition and backwatering (Table 7). The cost estimate for this fix was $25,000 to open up 430 m of habitat with a value rated as moderate. A habitat survey is recommended to determine the value of habitat located

upstream of this crossing. Crossing 546485 was considered low priority due to its significant cost. This crossing is located under the Lougheed Highway and would need to be replaced with a bridge, with costs estimated at $887,000, to restore passage upstream. Although it will not likely be feasible to rehabilitate crossing 546485 and restore connectivity within all reaches of the stream, the rehabilitation of 546478 could serve as an opportunity for community groups and government agencies to partner in a fish habitat awareness and restoration program within the lower reaches. It should be noted that there are mapping discrepancies between water layers for this stream. According to the 1:50,000 trim layer the crossing 546485 is the upper most crossing in the watershed, however the BC Watershed Atlas stream centre line network layer (1:50,000) indicates that the stream drains from further west and passes through crossings 546495 and 546489. It is likely that the BC Watershed Atlas layer is correct as the layout matches mapping presented in Davies (1996) report. If this is the case there could be several crossings located between the Lougheed Highway and crossing 546495 that were not assessed.

Table 8. Summary of analysis phase for the Alouette River watershed.

ID	*Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
544996	RP	1.30	EM/BW		15	0.087	CB	6X4	54	0.024
545647	Unknown	0.22	SB	12X4	274	0.001				
545649	Unknown	0.16	SB	12X8.5	239	0.001				
545650	Park	0.12	SB	12X8.5	239	0.001				
545719	Park	0.34	SS	2X25	114	0.003				
545927	Park	3.82	CB	3X20	114	0.033				
545946	Unknown	0.67	CB	4X4.3	38	0.018				
545956	Unknown	0.10	SB	12X4	113	0.001				
545983	**Unknown**	**5.04**	**SB**	**6X4**	**61**	**0.083**				
546043	Unknown	1.22	CB	6X4.3	61	0.020				
546061	**Park**	**1.86**	**EM/BW**		**60**	**0.031**				
546067	Urban	1.63	SS	1.8X25	198	0.008				
546118	Park	3.22	SS	2.13X65	1422	0.002				
546225	Urban	5.30	CB	4X4.3	39	0.134				
546241	Urban	0.14	CB	6X8.5	355	0.0004				
546242	Urban	0.76	SB	6X4.3	142	0.005				
546290	Urban	0.45	CB	2.7X35	451	0.001				
546350	Urban	0.39	SS	2.7X35	458	0.001				
546383	Urban	1.31	EM/BW		60	0.022	OBS	1.8X50	787	0.002
546384	Urban	0.67	SS	1.6X25	185	0.004				
546400	Urban	1.04	EM/BW		40	0.026	OBS	1.6X20	208	0.005
546402	Unknown	0.86	SS	2.7X35	477	0.002				
546409	Urban	2.15	SS	3.4X35	772	0.003				
546478	**Urban**	**0.43**	**BW**		**25**	**0.017**	**OBS**	**2.4X40**	**530**	**0.001**
546485	Urban	0.10	SS	2.1X60	887	0.0001				
CV4	Unknown	1.22	CB	6X4	61	0.020				
CV6	Unknown	*	CB	4X4.3	38					
CV7	Unknown	*	CB	4X4.3	38					

*RP: road permit, FSR: Forest Service Road. **No HGI information available

3.2.2 Blaney Creek

A total of 50 crossings were identified within the Blaney Creek watershed by GIS with 49 crossings identified as fish bearing or potentially fish bearing (Table 5). The majority of crossings located in the Blaney Creek watershed are located within or beyond the University of British Columbia Malcolm Knapp Research Forest or behind locked gates on private land. Access to the research forest was not granted by the manager as the university has already conducted its own fish passage studies in the area. For this reason and because of the presence of extensive gated areas throughout the remaining watershed only three crossings were surveyed. One crossing was a bridge and two crossings were round culverts. Crossing 546086 is located on a tributary to Spring Creek within an urban neighborhood and was determined to be a barrier to fish passage. Installation of an open bottom arch was recommended as the fix for the crossing with a cost estimate of $238,000. This crossing is rated as a low priority for replacement due to a low cost benefit ratio (Appendix 4).

Table 9. Summary of analysis phase for the Blaney River watershed.

ID	*Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
546086	Urban	0.49	SS	1.8X25	238	0.002				

3.2.3 Cascade Creek

The majority of streams within the Cascade Creek watershed were identified as high gradient (>25%) with only seven crossings out of 98 identified by GIS located on streams modeled as potentially fish bearing (Table 5). Of these seven crossings, two could not be located and three were located behind gated private land areas. Access was requested to crossing 545916 from the landowner but was denied. One bridge and one culvert were assessed. The culvert was determined to be a potential barrier to fish passage. No fix was recommended for the crossing as there was only a very small amount of poor fish habitat available upstream.

3.2.4 Coquitlam River

A total of 269 crossings were identified by GIS within the Coquitlam Watershed (Table 5). Of these, 80 crossings were located on stream segments modeled as non fish bearing and 189 were on potentially and confirmed fish bearing stream segments. Four crossings not identified by GIS were encountered in the field. The Greater Vancouver Regional District (GVRD) watershed is located within the upper reaches of the Coquitlam River and reservoir. Access to the area requires significant consultation with the GVRD and would have required more time to achieve than was available for surveying in the fall of 2011. For this reason, 85 crossings modeled as fish bearing or potentially fish bearing were removed from the study. In addition, 42 crossings out of 108 identified as candidates for inspection (outside of the GVRD watershed) were not assessed. Eleven crossings were located behind locked GVRD, Pinecone Burke Park or private property gates; 12 were incorrectly mapped as within the watershed when in fact they drained into the Fraser River directly (Mundy Creek), 10 could not be located in the field, and the remaining nine crossings were eliminated for a variety of reasons (duplicates of other crossings, no HGI upstream, etc.).

In total 66 crossings were surveyed in the field. Forty three of the crossings surveyed were CBS and twenty three were OBS or "other" crossings.

Crossing 545770 on Scott Creek is considered a high priority for rehabilitation (Table 6). The inlet of this round culvert is located at the downstream edge of a beaver dam and pond. According to GIS modeling there is over 6 km of habitat upstream with gradients suitable for rearing and overwintering. Observations of multiple regionally important anadromous salmonid species such as coho salmon, Chinook salmon (*O. tshawytscha*), anadromous cutthroat trout and stealhead trout (*O. mykiss*) within the stream (FISS) warrants a habitat assessment upstream to confirm available habitat. The beaver pond located directly above the crossing appears to be suitable for coho salmon rearing. The crossing is a candidate for outlet pond works with fish passage pools and drops/jumps installed. The estimated cost of the fix is $40,000. Crossing 545835 located downstream on Scott Creek approximately 1.1 km was also identified as a barrier due to an outlet drop of 0.6 m. This crossing is a moderate priority for remediation, which would involve outlet weir works and substrate addition at a cost of $65,000. The culvert is currently passable to large anadromous salmonids using the corridor to access spawning habitat upstream.

Some scour was noted at pipe arch crossing 545876 located on Hoy Creek. Additionally, signs of erosion were noted at the footing of the pipe arch crossing 545890.

Table 10. Summary of analysis phase for the Coquitlam River watershed.

ID	*Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
544898	RP	0.82	CB	4X8.5	166	0.005				
545702	Urban	3.30	SS	3.4X30	362	0.009				
545766	Urban	0.27	SS	1.5X22	131	0.002				
545770	**Urban**	**6.04**	**EM/BW**		**40**	**0.151**				
545799	Urban	0.05	CB	10X50	1,497	0.000				
545808	Urban	0.14	RM		8	0.019	CB	4X4.3	37	0.004
545822	Urban	0.25	BW		25	0.010	OBS	1.4X25	142	0.002
545827	Urban	0.17	CB	10X8.5	610	0.000				
545832	Urban	0.10	CB	10X8.5	610	0.000				
545835	**Urban**	**1.16**	**EM/BW**		**65**	**0.018**				
545844	Urban	0.15	CB	12X8.5	707	0.000				
545857	Urban	0.29	EM/BW		100	0.003				
545998	Urban	0.00	SS	4X100	1000	0.000	BW		18	0.000
546278	Urban	0.10	SS	3.1X50	845	0.000				
CV404	Urban	0.00	SS	1.8X2.5	172	0.000				
CV406	Urban	0.00	CB	12X8.5	707	0.000				
CV407	Urban	0.00	CB	12X8.5	707	0.000				
CV408	Urban	0.32	OBS	4x6	25	0.013				
CV409	Urban	0.00	SS	213X20	1000	0.000				

*RP: road permit, FSR: Forest Service Road. **No HGI information available

3.2.5 Hatzic Slough

A total of 54 crossings were identified by GIS in Hatzic Slough (Table 5). Of these, six crossings were located on stream segments modeled as too steep for fish habitat and were eliminated from the sample plan. Three additional crossings were identified in the field. Twenty-two crossings identified as fish bearing or potentially fish bearing were not surveyed in the watershed. Eleven of these crossings were not surveyed because they were located on private land. The remaining crossings were eliminated from the study for various reasons, including: crossings were not present in the field; crossings were located on streams with high gradients; or there was a lack of habitat upstream. A total of 29 crossings were surveyed in the Hatzic Slough watershed. Twenty of these crossings were CBS and nine were OBS.

Crossing 546512 on Kenworthy Creek was identified as high priority for restoration (Table 6). Habitat at the crossing was rated as high at the crossing location. Coho and 'unidentified salmon' (AO) have been reported at the crossing (FISS), and 2.49 km of modeled fish bearing stream is present upstream. A concrete bridge at an estimated cost of $175,000 is recommended to remediate this crossing.

Crossings 546460 and 546473 were ranked as medium priority for remediation (Table 7). Both of these culverts were considered potential barriers to fish passage and were located on streams with habitat value rated as high and moderate, respectively. Passage in both of these culverts is due to backwatering by beaver dams downstream, and passage may not be possible if these dams are removed. Remediation works for 546460 would involve backwatering and substrate addition at a cost of $25,000. An arch culvert is recommended at crossing 546473 at an estimated cost of $99,000. Chum salmon and sculpin species are reported below these crossings.

Table 11. Summary of analysis phase for the Hatzic Slough watershed.

ID	*Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
314	Urban	1.30	SS	1.8X18	124	0.011				
546460	**Urban**	**1.45**	**EM/BW**	**6X8.5**	**25**	**0.058**				
546473	**Urban**	**5.00**	**SS**	**1.4X16**	**99**	**0.050**				
546512	**Urban**	**2.49**	**CB**	**6X8.5**	**175**	**0.014**				
546517	Urban	0.26	SS	1.4X8.0	57	0.005				
546615	Urban	1.22	CB	4X8.5	118	0.010				
546643	Urban	0.65	CB	6X8.5	175	0.004				
546732	Urban	0.92	SS	2.1X15	143	0.006				

3.2.6 Kanaka Creek

A total of 107 crossings were identified in the Kanaka Creek watershed by GIS and a further 19 were identified in the field (Table 5). Fifty-six of the crossings identified by GIS were not assessed in the field. Twenty three of these crossings were considered on non-fish bearing streams based on information gathered from local woodlot managers. The remaining 33 crossings were eliminated for reasons including: road washouts, steep gradients and crossings were not present in the field. Substantial areas of the watershed were located within woodlots managed by the British Columbia Institute of Technology

(BCIT) as well as Quantlan First Nations. Access was gained to these areas through keyed gates. In total, 70 crossings were surveyed in Kanaka Creek. Forty-four crossings were CBS and 26 were OBS or "other". Six crossings were considered high or moderate priority for restoration (Tables 6 – 7).

Crossings 546366 and 546440 are located on a tributary to Kanaka Creek upstream of a pair of waterfall barriers that limit access of anadromous fish species to the stream. Crossing 546440 is located on Dwedney Trunk road, 546336 is the next crossing 1.1 km upstream. Resident cutthroat trout are present 1.8 km downstream of 546440; however, no information is available on fish presence in the remainder of the tributary. Habitat value at both crossings was rated as high with abundant cover available in the form of boulders, deep pools and overhanging vegetation. Some pockets of gravels were also present. A concrete bridge is recommended at crossing 546366, and backwatering and substrate addition could be conducted at crossing 546440. The combined cost of remediating both structures is $257,000, which would provide access to up to 11 km of modeled stream habitat. Further fisheries inventories upstream of the crossings are recommended before restoration is considered to determine if cutthroat are already present.

Crossing 546435 is located on a tributary to Kanaka Creek (WSC: 100-037400-33200), approximately 1.8 km upstream of a 6 m waterfall. Habitat value was rated as high with abundant deep pools, large woody debris, overstream vegetation and gravels suitable for spawning. The crossing, which consists of a twin culvert, is a candidate for works on the southern smaller pipe including backwater and substrate addition. Alternatively, the crossing could be replaced with a steel bridge. Cutthroat trout have been reported upstream of 546435 approximately 1 km (FISS) and 3 km (Whitford, 2009). The presence of cutthroat trout upstream indicates the remediation of this culvert would serve to restore connectivity within the stream. A priority rating of moderate was given for remediation of this crossing.

Crossing 546351 is located on a tributary to Kanaka Creek (WSC: 100-037400-33200-19400), 950 m upstream of crossing 546435. Habitat was considered excellent at this crossing, with abundant cover from deep pools, undercut banks and over stream vegetation. This crossing was given a moderate priority for remediation as it will provide access to ~1.8 km of additional habitat. Backwatering and substrate addition at a cost of $60,000 was recommended for remediation.

Approximately 28 crossings upstream of crossing 546435 were not assessed due to non-fish bearing status (Blue Mountain Woodlot License (W0038) Plan), road washouts, or the lack of defined stream channels.

Crossing 546516 is a concrete box culvert located on a tributary to Dunlop Creek. Coho, chum and cutthroat are reported immediately downstream. Remediation of this crossing would provide access to 400 m of habitat at a cost of $20,000, as only a minor amount of work is required at the outlet and additional baffles are required within the culvert.

Crossing 546433 is located on the mainstem of Kanaka Creek under the Dewdney Trunk road. Resident cutthroat trout have been observed within adjacent reaches of the stream, although downstream barriers prevent access for anadromous fish species. Habitat value at the crossing was considered high with low gradient (1%) and abundant cover available in the form of boulders, deep pools, and overhanging vegetation. No gravels were observed. This crossing was considered a candidate for baffle installation, substrate addition and backwatering. Alternatively, installation of a concrete bridge (12 m span) is recommended. Waterfalls are present approximately 1.3 km and 3.3 km upstream of the crossing. No information is available on the lower waterfall, however pictures of the upper waterfall indicate it is impassable at all flows.

Crossing 545017 was an old log bridge in need of repair. The bridge was deteriorating with one log collapsing into the creek. The crossing is located in the Anderson Woodlot.

Table 12. Summary of analysis phase for the Kanaka Creek watershed.

ID	*Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
545006	FSR	0.00	SB	6X10	59	0.021				
546168	Urban	0.22	SS	1.8X22	189	0.001				
546224	Urban	0.59	CB	8X8.5	254	0.002				
546351	**Urban**	**1.79**	**EM/BW**		**60**	**0.030**	**OBS**	**3.4X25**	**310**	**0.006**
546366	**Urban**	**9.96**	**CB**		**197**	**0.051**				
546396	Urban	0.46	CB	10X8.5	532	0.001				
546433	**Urban**	**1.20**	**EM/BW**	**12X20**	**85**	**0.014**	**CB**		**516**	**0.043**
546435	**Urban**	**1.80**	**EM/BW**		**85**	**0.021**	**SB**		**500**	**0.051**
546440	**Urban**	**1.06**	**EM/BW**		**60**	**0.018**				
546458	Urban	0.08	EM/BW		70	0.001				
546482	Urban	0.22	SS	1.8X40	998	0.000				
546510	Urban	0.54	SS	1.8X40	458	0.001				
546516	**Urban**	**0.40**	**EM/BW**		**20**	**0.020**				
546526	Urban	0.38	SS	1.4X20	113	0.003				
546527	Urban	0.42	SS	2.1X28	369	0.001				
546532	Urban	0.72	SS	2.4X22	264	0.003				
546553	Urban	1.15	BW		20	0.058				
546555	Urban	0.52	EM/BW		60	0.009	SB	8X8.5	787	0.001
546568	Urban	0.22	CB	6X4.3	95	0.002				
546570	Urban	0.74	CB	12X8.7	593	0.001				
CV109	Urban	0.58	SS	2.1X22	207	0.003				
CV111	Driveway	0.12	SS		294	0.000				
CV112	Urban	0.55	SS	1.8X25	255	0.002				
CV113	Urban	0.55	SS	1.8X25	127	0.004				
CV401	Urban	0.38	SS	1.8X32	268	0.001				
CV402	Urban	0.00	SS	1.8X40	598	0.000				

* FSR: Forest Service Road.

3.2.7 Katzie Slough

A total of 41 crossings were identified by GIS in the Katzie Slough watershed (Table 5). All these crossings were on stream segments modeled as potentially fish bearing or confirmed fish bearing. An additional 10 crossings were encountered in the field. Twenty-eight crossings were eliminated from the study for a number of reasons, but predominantly because they were not present in the field (13 crossings). Other reasons for exclusion included: located in areas of very high traffic volume which created unsafe conditions for surveying; located on private industrial lands; or no longer connected to downstream lengths of stream due to urban, industrial and agricultural development. A total of 23 crossings were surveyed in the Katzie Slough watershed. Of these, fifteen crossings were CBS and eight crossings were OBS. Only one of the CBS surveyed was considered a barrier, crossing 546208 located on Cranberry Slough. Although the GIS water layer indicates that this stream connects with Katzie Slough, in the field it appeared as though the section of stream west of the eastern on-ramp of the Pitt River Bridge was no longer connected to the western portion of the slough. This anomaly is either a mapping error or the stream has been buried during highway or bridge construction. At the time of the survey the portion of stream west of the eastern on-ramp to the Pitt Bridge flowed to Katzie Slough to the south while the portion of stream on the east side of the on ramp flowed in a north easterly direction to the Alouette River. As crossing 546208 was located at the upstream end of the eastern portion of the slough with no fish habitat available upstream, no fix was recommended.

3.2.8 Lagace Creek

A total of 41 crossings were identified by GIS in the Lagace Creek watershed, with 24 of these on fish bearing or potentially fish bearing streams (Table 5). One additional crossing was identified in the field. Five crossings were not assessed. Three of the crossings not assessed were on private land and two could not be identified in the field. Of the 20 crossings assessed in the Lagace Creek watershed, 13 crossings were CBS and seven crossings were OBS. One crossing on Oru Creek (546314) was deemed a moderate priority for replacement (Table 7). A steel bridge was the recommended fix with an estimated cost of $175,000 to open up approximately 1.5 km of potentially high value habitat. Chum and coho are present downstream of the culvert, and local residents report that they used to move upstream past the culvert.

Additional fisheries information is required for crossings assessed as barriers on a tributary to Lagace Creek (crossing 546122) and MacNab Creek (crossing 546067), however, habitat was rated low for both of these streams and they are considered low priority for further action (Appendix 4).

Table 13. Summary of analysis phase for the Lagace Creek watershed.

ID	Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
546076	Urban	0.65	CB	8X8.5	72	0.009				
546089	Urban	0.88	SS	2X20	146	0.006				
546122	Urban	0.19	EM/BW		20	0.009	SS	1.4X22	100	0.002
546314	**Urban**	**1.53**	**CB**	**8X8.5**	**175**	**0.009**				

3.2.9 Lost Creek

A total of 125 crossings were identified by GIS in the Lost Creek watershed (Table 5). Sixty-three of these crossings were identified as being located on stream segments modeled as fish bearing or potentially fish bearing. No additional crossings were identified in the field. Forty-four crossings were not assessed in the Lost Creek watershed. The most common reason that crossings were not surveyed was that they were located on roads that had been deactivated and were impassable (28 crossings). The remaining crossings were eliminated for a number of reasons including steep gradients and GIS generated duplicate crossing IDs. A total of 19 crossings were surveyed in the Lost Creek watershed. Eight of these crossings were identified as CBS. Seven of these were considered barriers and one crossing was considered a potential barrier. None of these were considered a priority for further action.

A poorly deactivated crossing (544802) was noted in Lost Creek that should be remediated. A log culvert is present at this location and aggradation of the streambed onto the structure has caused a portion of the stream to overflow onto the road and down towards an adjacent stream, resulting in significant erosion of the road bed.

Table 14. Summary of analysis phase for the Lost Creek watershed.

ID	*Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
544806	FSR	0.91	CB	6X4.3	61	0.015				
544864	FSR	0.09	CB	6X4.3	56	0.002				
544865	FSR	0.10	CB	6X4.3	56	0.002				
544872	FSR	0.16	CB	4X4.3	37	0.004				

FSR: Forest Service Road.

3.2.10 North Alouette River

A total of 42 crossings were identified by GIS in the North Alouette River watershed (Table 5). The upstream end of the North Alouette River watershed is accessed through the UBC Malcolm Knapp research forest. Access to the research forest was not possible at the time of the survey, and 23 crossings in the upper part of the watershed were eliminated from the study. Additionally, seven crossings were not present at the GIS modeled locations. In total 12 crossings were assessed in the watershed. Six of the crossings assessed were CBS and six were OBS.

Crossing 546179 on a tributary to the North Alouette River was identified as a high priority for follow up action (Table 6). This crossing is on an urban road and is considered a barrier due to slope, length and lack of embedment. No fisheries information is available for this tributary, although the presence of log structures upstream of the crossing implies potential spawning habitat. The crossing has a modeled HGI of 2.89 km. An 18 x 9 m open bottom arch culvert is recommended as a replacement for the culvert with an estimated cost of $249,000 and a cost benefit ratio of 0.012 km/$K.

Table 15. Summary of analysis phase for the North Alouette River watershed.

ID	*Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
546132	Urban	0.41	CB	6X8.5	191	0.002				
546179	**Urban**	**2.89**	**SS**	**1.8X30**	**246**	**0.012**				

3.2.11 North Fraser River

A total of 164 crossings were identified by GIS in the North Fraser River study area (Table 5). Streams in this study area drain into the Fraser River between the Katzie Slough, Kanaka Creek, Stave River and Hatzic Slough watersheds. The North Fraser River study area was included in the study to fill in the areas not included in the other watershed polygons. Twenty-three crossings were identified as being located on stream segments modeled as non fish bearing. Streams were surveyed from west to east with crossing 546846 being the furthest crossing to the east (located west of Mission - approximately 2.5 km east of the mouth of the Stave River). Ninety-six crossings were not assessed within the surveyed North Fraser study area. Eighty-two of these could not be completed due to cost constraints; these are all located east of crossing 546846. Nine crossings were not present, two crossings were GIS generated duplicates, and three crossings were located on impassable deactivated roads. Forty five crossings were surveyed, 42 were CBS and three were OBS. One crossing was rated as a high priority for remediation and five crossings were rated as moderate priorities.

Four crossings on York Creek were identified as barriers. Coho salmon, chum salmon and cutthrout trout are recorded at the mouth of the stream. Crossing 546740, located near the confluence with the Fraser River, was rated as a low priority for rehabilitation as this crossing is likely passable to most adult anadromous salmonids at most stream flows. A combination of backwatering, substrate addition and the installation of baffles are recommended to remediate the crossing at an estimated cost of $60,000. Crossing 546722, located approximately 600 m upstream of the mouth of York Creek, is a round culvert with concrete bottom and baffles. This crossing was rated as a high priority for remediation, as the outlet drop of 65 cm is a barrier to fish passage. Small concrete baffles are present in the culvert indicating fish passage was a consideration during installation. One chum salmon was observed downstream of the culvert during the assessment. Personal communications with a local resident indicated that crossing 546722 was installed 2-3 years ago. The crossing is a candidate for backwatering and the installation of a stepped outlet to enhance fish passage. The cost estimated for the fix is $60,000 for an HGI of 1.67 km. FISS records indicated that there is a 2 m high rock fall located approximately 160 m upstream of the crossing. This could present an obstacle to fish passage for migrating fish and should be confirmed in the field. Two crossings, 546616 and 546591, upstream of crossing 546722 are considered barriers with a low priority for replacement, due to moderate habitat and relatively high cost for remediation. Both were rated as low priorities for rehabilitation with a combined cost estimate of $475,000 to replace both structures with open bottom arch culverts (Appendix 4). The eventual rehabilitation of all structures on the stream should be considered to restore connectivity throughout York Creek. Crossing 546691 also located on the stream was assessed as a potential barrier however the crossing is likely passable. This should be confirmed if restoration work is pursued within

York Creek. The combined cost estimate to rehabilitate all crossings in York Creek is $593,000 to provide access to 3.13 km of habitat.

Whonnock Creek flows in a south-westerly direction into the Fraser River approximately 3 km west of the mouth of the Stave River. Chum, coho, pink salmon, steelhead, as well as resident and anadromous cutthroat trout have been confirmed within the stream (FISS). Two crossings (546506 and 546738) on Whonnock Creek were assessed as barriers to fish passage. Reports of coho salmon and steelhead trout within and above Whonnock Lake indicate that both of these crossings 546506 and 546738 are passable to adult coho and steelhead (FISS). Crossing 546738 is located near the mouth of Whonnock Creek at the Lougheed Highway. This crossing is an oval culvert and appears passable to large fish. Dead chum were observed upstream and downstream of the crossing. However, the addition of baffles into the haunches of the existing structure to facilitate passage at an estimated cost of $60,000 is recommended. Crossing 546506 is a perched round culvert with no additional features to facilitate fish passage. The road at the crossing location is on a junction and slight compression curve which normally would require an open bottom arch; however, the size of the stream warrants a 12 m bridge on spread footings with batter walls 4 m high at an estimated cost of $413,000. This would provide access to an additional 12.6 km of habitat.

Crossings 546588 and 546699 are located on a tributary to Whonnock Creek (WSC: 100-045300-10200). Both crossings were rated as moderate priorities for follow up action (Table 7). FISS records indicate coho salmon have been reported upstream of both of these crossings, although these records are from 1994 and the crossings may have been modified since that time. Crossing 546699 is considered passable for larger fish, and there are several crossings on private land located downstream of crossing 546588 that should be assessed before any remediation of the priority crossings. The combined cost for remediation of 546588 and 546699 is estimated at $85,000 for a total HGI of 3.5 km. A fish inventory and habitat assessment is recommended.

Crossing 546882 is located on Jamieson Creek, a tributary of the Fraser River located within the District of Mission. A small amount (180 m) of habitat is present above the culvert, including gravels and pools. The crossing is a concrete box culvert equipped with baffles and substrate, and is expected to be passable to larger fish. Outlet control rockwork for the culvert appears to have shifted or eroded, which may result in a velocity barrier at the mouth. Remediation of the crossing would involve backwatering with the installation of outlet control rockwork to a Q100 standard at an estimated cost of $8,000. Several additional crossings are barriers upstream in Jamieson Creek and habitat throughout Jamieson Creek could be assessed in more detail.

Table 16. Summary of analysis phase for the North Fraser area.

ID	*Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
546495	Urban	0.68	SS	3X45	654	0.001				
546504	Urban	0.51	SS	2.7X200	5000	0.000				
546506	**Urban**	**12.58**	**CB**	**12X14**	**413**	**0.030**				
546514	Urban	0.23	SS	2.7X75	2126	0.000				
546515	Rural	1.15	SS	2.1X25	227	0.005				
546580	Urban	0.19	EM/BW		30	0.006				
546588	**Urban**	**1.97**	**EM/BW**		**45**	**0.044**				
546590	Urban	0.23	SS	1.8X20	104	0.002				
546591	Urban	0.59	SS	2.7X14	113	0.005				
546616	Urban	0.49	SS	3.4X25	360	0.001				
546682	Urban	0.30	SS	2.1X40	294	0.001				
546685	Urban	0.32	CB	12X8.5	408	0.001				
546697	Urban	4.43	SS	2.1X65	1800	0.002				
546699	**Urban**	**1.51**	**EM/BW**		**40**	**0.038**				
546722	**Urban**	**1.67**	**EM/BW**		**60**	**0.028**				
546738	**Urban**	**6.31**	**EM/BW**		**60**	**0.105**				
546740	Urban	0.38	EM/BW		60	0.006				
546753	Urban	0.69	SS	1.6X20	123	0.006				
546756	Urban	3.36	SS	2.1X65	1800	0.002				
546756A	Railway	0.05	EM/BW		50	0.001				
546767	Urban	0.18	SS	1.4X50	594	0.000				
546780	Railway	0.14	SS	1.4X10	27	0.005				
546846	Urban	2.10	SS	1.2X14	90	0.023				
546859	Urban	0.26	SS	1.4X25	135	0.002				
546862	Urban	0.07	BW		25	0.003				
546882	**Urban**	**0.18**	**BW**		**8**	**0.024**				

3.2.12 Pitt River

A total of 101 crossings were identified by GIS in the Pitt River watershed (Table 5). An additional 31 crossings were identified in the field. Ten crossings identified by GIS were located on stream segments modeled as high gradient (>25%) and were eliminated from the field plan. Fifty-seven crossings were not assessed in the watershed. Sixteen crossings were not assessed due to locked gates preventing access to private property, the UBC Malcolm Knapp Research Forest, Pinecone Burke Provincial Park or municipal pathways. Eight crossings were not assessed as they were boat access only. The remaining crossings were not assessed for a variety of reasons including steep gradients, the crossings were not present, or the crossings were GIS generated duplicates of other surveyed crossings. The 65 crossings that were assessed in the Pitt River watershed were predominately in urban areas. Thirty-four crossings were CBS and 31 were OBS. One crossing (CV8) was identified as moderate priority for rehabilitation (Table 7). This crossing is on a small non-trim stream and contains habitat suitable for salmonid spawning and rearing, with gravels, LWD, undercut banks and overhanging vegetation. Nearby crossings on adjacent streams (*e.g.* 545746) have been rehabilitated and are being utilized by chum salmon to

access similar habitat for spawning as that observed upstream of crossing CV8. The cost benefit ratio is low (0.003 km/$K) as only 100 m of habitat is available before the stream gradient increases.

Table 17. Summary of analysis phase for the Pitt River watershed.

ID	*Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
545677	Urban	0.10	CB	4X4.7	37	0.003				
545724	Urban	0.51	SB	10X8.5	202	0.003				
545948	Urban	0.35	SB	12X8.5	546	0.001				
545950	Urban	2.52	CB	8X8.5	319	0.008				
546356	Urban	0.34	SS	2.7X30	371	0.001				
CV25	Urban	0.42			80	0.005				
CV8	**Urban**	**0.1**	**SS**	**1.2X14**	**35**	**0.003**				
CV9	Urban	0.00	SS	2.1X14	57	0.000				

3.2.13 Stave River

A total of 419 crossings were identified in the Stave River watershed by GIS (Table 5). Of these, 230 crossings were located on stream segments modeled as fish bearing or potentially fish bearing. An addition 13 crossings were identified in the field. A total of 133 crossings that were modeled as fish bearing or potentially fish bearing streams were not assessed. Twenty eight crossings were accessible by boat only, 36 were behind locked gates or on inaccessible private land, and 33 crossings were on deactivated impassable roads. Twenty one crossings were identified as GIS generated duplicates of other assessed crossings. The remaining crossings were either too steep, on roads that were overgrown, or could not be located in the field. A total of 110 crossings were assessed in the watershed. Seventy crossings were CBS and 40 were OBS or "other" crossings.

Two crossings on Phillips Creek were rated high or moderate priority for remediation (Table 6 and 7). Cutthroat trout have been observed in the stream upstream of both crossings (FISS). Crossing 546427 is a concrete bottomed round culvert with baffles located under the Dewdney Trunk Road. The crossing is a candidate for stepped outlet to enhance fish passage at a cost estimated at $25,000 for a modeled gain of 1.05 km of high value habitat. Crossing 546250 is upstream of crossing 546427 and was rated as a moderate priority for remediation. Beaver activity was noted upstream and there was an abundance of rearing habitat present at the time of assessment. The crossing is a candidate for backwatering with a cost estimate of $25,000 for access to 0.91 km of moderate habitat. An additional crossing (546303) located between these two, is a potential barrier to fish passage, and should be investigated further. Remediation of this crossing would require an open bottom arch culvert at an estimated cost of $114,000.

Two crossings, 546270 and 546334, on Steelhead Creek were identified as moderate priority for restoration (Table 7). Steelhead falls, located near the confluence with the Hayward Reservoir prevents access from lake resident fish into Steelhead Creek. Resident rainbow trout were historically stocked in

Steelhead Creek, and are presumed to be present (FISS). Crossing 546270 is located approximately 2.3 km upstream of the confluence with Hayward Reservoir. Fish habitat at the crossing location was rated as high value. The crossing is likely passable to adult fish during most stream flows. The crossing was considered a candidate for streambed retention structures, as the existing pipe appeared to be large enough to work in safely and accommodate storm flows (P. Eng to certify), at an estimated cost of $25,000. Crossing 546334 is located under the Dewdney Trunk Road and is the next crossing upstream from crossing 546270. Habitat value was rated high and the addition of substrate and backwater at a cost of $30,000 is recommended. There are several crossings assessed as barriers on tributaries to Steelhead Creek. These are crossings 546243, 546222, 546373, 546436. Replacement or remediation of these crossings is recommended to restore the watershed as a whole. Note that resident rainbow trout are expected throughout Steelhead Creek, and hence restoration activities would reestablish connectivity within the stream.

Two crossings on Hairsine Creek and one crossing on a tributary to Hairsine Creek were rated as moderate priority for remediation or replacement (Table 7). Resident cutthroat trout and rainbow trout have been reported in Hairsine Creek (FISS). Crossing 546600 is located approximately 2 km upstream from the mouth of Hayward Reservoir. Small baffles were present within the structure and likely enable passage of large fish through the culvert. Habitat value was rated as high. The crossing is a candidate for backwatering and embedment by installing larger internal devices and adding substrate at an estimated cost of $38,000. Crossing 302 is the next crossing upstream from crossing 546600. The crossing is a candidate for baffle installation and backwatering for an estimated cost of $20,000. This crossing may be passable to larger fish in its current state. Crossing 546575 is a barrier on a tributary to Hairsine Creek. No fisheries information is available on this tributary, which would require an open bottom arch at an estimated cost of $101,000. This would provide access to 1.28 km of habitat rated as moderate in value. Further fisheries information is warranted on this crossing.

Two crossings on tributaries to Cardinalis Creek were considered a moderate priority for further assessment (Table 7). Crossing 310 is located on a non-trim stream under Sabo Road. Moderate quality habitat is present upstream, including gravels for spawning and cover. No fish information is available for this stream, although resident rainbow trout and dolly varden (*Salvelinus malma*) are suspected as they are reported in nearby Cannell Lake (FISS). An estimated 0.91 km of habitat is accessible upstream. Remediation using an arch culvert at a cost of $64,000 is recommended. Verification of habitat quantity and fish presence is recommended for this crossing. Crossing 546227 is also located on an unnamed stream (WSC: 100-47100-21600-91600) and resident rainbow trout and dolly varden are suspected due to their presence in Cannell Lake. The crossing is a concrete box culvert with some baffles present. Fish habitat at the crossing was considered moderate, with some gravels observed, and an estimated 1.23 km of habitat is present upstream. Remediation would require backwatering and adding substrate at an estimated cost of $25,000. Verification of habitat quantity and fish presence is recommended for this crossing.

Crossing 546449 is located on a tributary (WSC: 100-47100-7700) to Hayward Reservoir. The crossing is a culvert located underneath the Hayward Reservoir Recreation Trail, which was once the railway line connecting the Stave Lake Reservoir to the Town of Mission. The crossing is located 30 m upstream of the reservoir and the tributary should be accessible to species resident in the reservoir. Gravels suitable for spawning are present upstream of the crossing. Remediation of the crossing with an arch culvert or similar would make 1.57 km of modeled fish bearing habitat available, at an estimated cost of $36,000. Note that this tributary is reported to provide little habitat due to a boulder barrier at the upstream end of a 2 m culvert (Hemmerra 2009), which may refer to crossing 546449, although other than the culvert, no barrier was observed.

Several crossings in the Stave watershed study area require maintenance or removal, although they are not barriers to fish passage. Crossings 544580, 544604, 545421 and 545447 are located on tributaries to Terepocki Creek. Crossing 544580 is a collapsing log bridge, while the remaining three crossings are deteriorating wooden box culverts. Crossing 546188 is an old log crossing on a tributary to Steelhead Creek that has collapsed and is causing aggradation and scour, and should be deactivated properly.

Table 18. Summary of analysis phase for the Stave River watershed.

ID	*Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
302	**Urban**	**2.85**	**EM/BW**		**20**	**0.143**				
310	**RP**	**0.90**	**SS**	**1.2X14**	**64**	**0.014**				
544595	RP	0.09	CB	4X4.3	37	0.002				
544916	RP	0.00	SS	1.8X14	43	0.000				
544958	RP	0.17	SB	10X4.3	103	0.002				
544999	RP	0.12	SS	1.4X12	34	0.003				
545002	RP	0.02	SS	2.4X14	104	0.002				
545016	RP	0.40	SS	4X8.5	118	0.003				
545021	FSR	0.49	SB	12X4.3	184	0.003				
546184	Rural	0.60	SS	8X20	69	0.009				
546197	Urban	0.29	SS	2.4X18	129	0.002				
546222	Urban	1.01	CB	6X8.5	179	0.006				
546227	**Rural**	**1.23**	**EM/BW**		**25**	**0.049**				
546243	Urban	0.32	CB	4X8.5	158	0.002				
546248	Urban	0.55	EM/BW		16	0.034				
546250	**Urban**	**0.91**	**BW**		**25**	**0.037**	**OBS**	**2.1X22**	**133**	**0.007**
546257	Urban	2.93	SS	3.3X30	493	0.006				
546263	Urban	0.29	CB	4X4.3	45	0.006				
546270	**Urban**	**1.96**	**EM/BW**		**25**	**0.078**				
546303	Urban	0.69	SS	2.1X18	114	0.006				
546334	**Rural**	**6.04**	**EM/BW**		**30**	**0.201**				
546373	Rural	1.42	SS	4X8.5	127	0.011				
546380	Urban	0.30	SS	3.4X33	555	0.001				
546408	Urban	0.25	SS	1.8X26	223	0.001				
546412	Urban	1.82	SS	2.4X35	701	0.003				

ID	*Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
546427	**Urban**	**1.05**	**EM/BW**		**25**	**0.042**	**OBS**	**3.4X30**	**835**	**0.001**
546436	Unknown	0.58	CB	4X4.3	37	0.016				
546449	**Rec**	**1.57**	**SS**	**1.2X14**	**36**	**0.044**				
546522	Urban	0.83	SS	1.8X28	230	0.004				
546524	Private	0.01	BW		25	0.000				
546525	Rec	1.43	CB	4X8.3	83	0.017				
546540	Urban	0.68	SS	1.4X30	241	0.003				
546541	Rec	0.07	CB	4X4.7	40	0.002				
546575	**Urban**	**1.28**	**SS**	**6X8.7**	**101**	**0.013**	**CB**	**6X8.7**	**180**	**0.007**
546583	Urban	1.55	CB	6X8.5	165	0.009				
546600	**Urban**	**0.55**	**EM/BW**		**38**	**0.015**				
546711	Urban	0.68	SS	1.6X18	155	0.004				
546745	Urban	1.08	SS	2.1X20	140	0.008				
546750	Rural	2.75	EM/BW		25	0.110	CB	6X8.7	198	0.014
546772	Rural	0.84	SS	1.8X24	177	0.005				
CV1	Urban	0.69	SS	12X12	29	0.024				
CV102	FSR	0.01	SS	1.4X12	34	0.0003				

*RP: road permit, FSR: Forest Service Road, Rec: Recreational.

3.2.14 Widgeon Creek

GIS identified a total of 92 crossings in the Widgeon Creek watershed (Table 5). One additional site was identified in the field. Thirty-six of the crossings identified by GIS were located on stream segments modeled as high gradient (>25%) and therefore non-fish bearing. The entire Widgeon Creek watershed is located behind a locked gate with access regulated by the GVRD parks department. A key was obtained for the field surveys. However, the large majority of the crossings in the watershed are located within the Pinecone Burke Provincial Park in areas where vehicular access is not permitted. Thirty-nine fish bearing and potentially fish bearing crossings were eliminated from the upper watershed for this reason. An additional eight crossings were eliminated from the study due to steep gradients, private property, overgrown roads, or because the crossings were not present in the field. Ten crossings were surveyed. Seven crossings were CBS and three were bridges. None of the crossings were considered high or moderate priority for further action. Crossing 545527 is a deteriorating box culvert on a tributary to Widgeon Creek that is in need of repair.

Table 19. Summary of analysis phase for the Widgeon Creek watershed.

ID	Road Type	HGI (km)	Proposed Solution 1	Size	Cost Estimate 1 ($K)	Cost Benefit 1 (km/$K)	Proposed Solution 2	Size	Cost Estimate 2 ($K)	Cost Benefit 2
545487	Unknown	0.15	CB	4X4.7	37	0.004				
545500	Unknown	0.08	CB	4X4.7	37	0.002				
545508	Unknown	0.10	CB	4X4.7	40	0.003				
545513	Unknown	0.09	CB	4X4.7	40	0.002				
545547	Unknown	0.05	CB	6X4.7	61	0.001				

4 SUMMARY AND CONCLUSION

A total of nine crossing were rated as high priority and 23 crossings were rated as moderate priority for further action in the Lower Fraser Watershed Group study area. The ranking system was based not only on cost benefit ratio and habitat value but also on numerous other factors including HGI, species of fish, existing fish distribution, passability of the existing structures to adult salmonid species, gradient, availability of fisheries information, and the presence/location of natural and anthropogenic barriers.

The urban setting of many of the watersheds surveyed presented access challenges resulting in exclusion from the study of over half the crossings identified. Follow up studies in areas not surveyed in this study may require boat assisted access as well as extensive planning to arrange admittance to municipal watershed areas, private lands, parks, and institutionally managed lands. The digital summary file and geodatabase included as Appendix 2 would be useful for planning of follow up surveys as it contains details regarding access issues for crossings that were not assessed in this study.

The urban and residential locale of many of these impacted streams provides a setting potentially conducive to restoration efforts. The high population densities present in many of the surveyed watersheds could present opportunities for partnerships between a variety of stakeholders including local restoration and stewardship groups, educational institutions and municipal governments among others.

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APPENDIX 1

Maps

APPENDIX 2

Digital Summary File (MS Excel) and Geodatabase

APPENDIX 3

Fish Barrier Scoring

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
302	Stave	No		10	0	0	0.3	0	2.00	5.4	2.7	6	20	3	19	Potential
303	Stave	No		10	0	0	0.0	0	2.00	4.0	2.0	6	14	0	16	Potential
304	Stave	No		10	0.02	0	1.0	5	0.60	1.8	3.0	6	12	0	21	Barrier
305	Stave	No		10	0.1	0	1.0	5	0.75	3.1	4.2	6	14	0	21	Barrier
307	Stave	Yes	0.10	5	0	0	0.0	0	1.20	1.7	1.4	6	15	3	14	Passable
308	Stave	No		10	9.99	10	30.0	10	9.99	50.0	5.0	6	44	6	42	Barrier
310	Stave	No		10	0.4	10	0.0	0	1.00	2.1	2.1	6	14	0	26	Barrier
314	Hatzic	No		10	0.25	5	2.0	5	1.00	3.0	3.0	6	15	3	29	Barrier
544595	Stave	No		10	0.4	10	5.0	10	0.90	1.9	2.1	6	10	0	36	Barrier
544804	Lost	No		10	2	10	4.0	10	1.50	3.5	2.3	6	15	3	39	Barrier
544805	Lost	No		10	0	0	0.5	0	0.90	1.7	1.9	6	10	0	16	Potential
544806	Lost	No		10	0.8	10	2.0	5	1.60	4.3	2.7	6	10	0	31	Barrier
544809	Lost	No		10	0.3	10	7.0	10	1.50	2.5	1.7	6	15	3	39	Barrier
544831	Lost	No		10	0.3	10	5.0	10	2.40	10.0	4.2	6	28	3	39	Barrier
544864	Lost	No		10	0.15	5	2.0	5	1.20	2.4	2.0	6	14	0	26	Barrier
544865	Lost	No		10	0.9	10	3.0	10	0.90	3.5	3.9	6	12	0	36	Barrier
544872	Lost	No		10	0.5	10	1.0	5	0.60	2.0	3.3	6	1	0	31	Barrier
544898	Coquitlam	No		10	0	0	2.0	5	0.60	2.1	3.5	6	15	3	24	Barrier
544914	Stave	No		10	0.2	5	0.0	0	0.85	1.9	2.2	6	10	0	21	Barrier
544916	Stave	No		10	0.2	5	4.0	10	1.20	2.9	2.4	6	13	0	31	Barrier
544958	Stave	No		10	1.4	10	4.0	10	1.90	2.6	1.4	6	14	0	36	Barrier
544981	Stave	No		10	1.6	10	0.0	0	1.4	4.3	3.1	6	12	0	26	Barrier
544984	Stave	Yes	0.10	5	0	0	0.0	0	1.30	3.0	2.3	6	12	0	11	Passable
544991	Stave	No		10	0	0	4.0	10	0.80	1.5	1.9	6	10	0	26	Barrier
544995	Stave	No		10	0	0	0.0	0	2	2.4	1.2	3	14	0	13	Passable
544996	Alouette	No		10	0.1	0	4.0	10	1.40	3.2	2.3	6	13	0	26	Barrier
544999	Stave	No		10	0.18	5	1.0	5	1.40	1.4	1.0	3	11	0	23	Barrier
545002	Stave	No		10	0.45	10	3.0	10	0.80	4.2	5.3	6	12	0	36	Barrier

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
545006	Kanaka	No		10	1.3	10	16.0	10	1.50	11.0	7.3	6	18	3	39	Barrier
545007	Stave	No		10	0.35	10	5.0	10	1.20	6.1	5.1	6	12	0	36	Barrier
545014	Stave	No		10	1.2	10	3.0	10	1.10	3.9	3.5	6	15	3	39	Barrier
545016	Stave	No		10	0.2	5	3.0	10	0.90	2.3	2.6	6	15	3	34	Barrier
545021	Stave	No		10	1.2	10	5.0	10	1.50	4.1	2.7	6	28	3	39	Barrier
545028	Stave	No		10	0.8	10	2.0	5	1.80	2.5	1.4	6	12	0	31	Barrier
545487	Widgeon	No		10	0.13	0	2.0	5	0.70	3.0	4.3	6	4	0	21	Barrier
545500	Widgeon	No		10	0.13	0	1.5	5	0.90	3.3	3.7	6	10	0	21	Barrier
545508	Widgeon	No		10	0	0	1.5	5	1.30	3.6	2.8	6	6	0	21	Barrier
545513	Widgeon	No		10	1.05	10	5.0	10	1.60	1.6	1.0	3	8	0	33	Barrier
545547	Widgeon	No		10	0.4	10	6.0	10	1.90	3.7	1.9	6	9	0	36	Barrier
545605	Pitt	Yes	0.70	0	0	0	0.0	0	1.50	1.5	1.0	3	12	0	3	Passable
545617	Widgeon	No		10	0.22	5	2.0	5	0.90	2.0	2.2	6	11	0	26	Barrier
545647	Alouette	No		10	0.46	10	4.0	10	2.40	6.5	2.7	6	25	3	39	Barrier
545649	Alouette	No		10	0.49	10	4.0	10	2.20	9.3	4.2	6	12	0	36	Barrier
545650	Alouette	No		10	1	10	3.0	10	2.00	6.1	3.1	6	15	3	39	Barrier
545653	Coquitlam	No		10	7	10	4.0	10	0.56	1.9	3.4	6	13	0	36	Barrier
545668	Coquitlam	Yes	0.10	5	0	0	1.0	5	0.90	2.5	2.8	6	13	0	16	Potential
545677	Pitt	No		10	0	0	1.0	5	0.60	1.3	2.2	6	8	0	21	Barrier
545681	Alouette	No		10	0.9	10	4.0	10	1.40	2.1	1.5	6	15	3	39	Barrier
545702	Coquitlam	No		10	0	0	4.0	10	1.60	4.2	2.6	6	30	6	32	Barrier
545719	Alouette	No		10	0.3	10	4.0	10	0.80	3.3	4.1	6	20	3	39	Barrier
545724	Pitt	No		10	0	0	1.0	5	3.60	5.4	1.5	6	8	0	21	Barrier
545730	Coquitlam	No		10	0	0	0.5	0	0.60	2.0	3.3	6	20	3	19	Potential
545746	Pitt	Yes	0.35	0	0	0	0.0	0	1.60	2.1	1.3	6	10	0	6	Passable
545766	Coquitlam	No		10	0.35	10	10.0	10	1.20	1.1	0.9	0	14	0	30	Barrier
545770	Coquitlam	No		10	0.5	10	1.5	5	2.60	1.5	0.6	0	28	3	28	Barrier
545778	Pitt	No		10	0	0	0.0	0	1.50	1.5	1.0	3	17	3	16	Potential

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
545793	Coquitlam	No		10	0	0	0.5	0	2.40	5.2	2.2	6	60	6	22	Barrier
545799	Coquitlam	No		10	0.4	10	12.0	10	0.90	1.7	1.9	6	68	6	42	Barrier
545808	Coquitlam	No		10	1	10	10.0	10	0.60	4.6	7.7	6	6	0	36	Barrier
545820	Coquitlam	No		10	0	0	0.2	0	1.20	1.6	1.3	6	10	0	16	Potential
545822	Coquitlam	No		10	0.23	5	1.5	5	0.90	1.0	1.1	3	25	3	26	Barrier
545824	Coquitlam	No		10	0	0	0.5	0	0.90	1.0	1.1	3	30	3	16	Potential
545827	Coquitlam	No		10	0	0	15.0	10	0.90	2.9	3.2	6	20	3	29	Barrier
545832	Coquitlam	No		10	0	0	18.0	10	0.90	2.3	2.6	6	14	0	26	Barrier
545835	Coquitlam	No		10	0.6	10	5.0	10	4.80	4.8	1.0	3	35	6	39	Barrier
545836	Pitt	Yes	0.30	5	0	0	0.5	0	1.80	1.1	0.6	0	2	0	5	Passable
545844	Coquitlam	No		10	0	0	8.0	10	1.20	2.4	2.0	6	19	3	29	Barrier
545857	Coquitlam	No		10	0.56	10	20.0	10	2.40	3.2	1.3	6	55	6	42	Barrier
545884	Pitt	Yes	0.50	5	0.15	5	6.0	10	2.50	2.5	1.0	3	14	0	23	Barrier
545927	Alouette	Yes		0	2.5	10	1.0	5	1.80	4.8	2.7	6	20	3	24	Barrier
545934	Pitt	Yes	1.00	0	0	0	0.0	0	4.50	4.5	1.0	3	15	3	6	Passable
545936	Pitt	Yes	1.00	0	0	0	0.0	0	3.80	3.8	1.0	3	30	6	9	Passable
545937	Pitt	Yes	0.30	5	0	0	0.5	0	2.50	1.1	0.4	0	5	0	5	Passable
545939	Pitt	Yes	0.50	5	0.3	10	0.0	0	3.70	2.8	0.8	0	20	3	18	Potential
545946	Alouette	No		10	0.14	0	1.0	5	0.60	2.1	3.5	6	8	0	21	Barrier
545948	Pitt	No		10	0.25	5	2.0	5	1.50	2.5	1.7	6	20	3	29	Barrier
545950	Pitt	No		10	0	0	2.0	5	3.10	4.3	1.4	6	17	3	24	Barrier
545952	Coquitlam	Yes	0.30	5	0	0	4.0	10	3.10	8.0	2.6	6	24	3	24	Barrier
545956	Alouette	No		10	0.83	10	3.0	10	2.30	2.7	1.2	3	12	0	33	Barrier
545964	Coquitlam	Yes	0.30	5	0	0	1.0	5	7.40	11.0	1.5	6	40	6	22	Barrier
545968	Coquitlam	Yes	0.40	5	0	0	0.5	0	4.50	2.8	0.6	0	18	3	8	Passable
545969	Coquitlam	No		10	0	0	0.5	0	0.70	1.2	1.7	6	18	3	19	Potential
545973	Pitt	Yes	0.60	5	0	0	0.0	0	3.60	3.6	1.0	3	14	0	8	Passable
545978	Coquitlam	Yes	0.15	5	0	0	0.5	0	0.90	1.3	1.4	6	18	3	14	Passable

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
545983	Alouette	No		10	0.5	10	3.0	10	1.80	6.0	3.3	6	20	3	39	Barrier
545985	Cascade	No		10	0	0	0.0	0	0.90	0.9	1.0	3	15	3	16	Potential
545989	Coquitlam	Yes		0	0	0	1.0	5	7.60	6.8	0.9	0	20	3	8	Passable
545992	Coquitlam	Yes	0.50	5	0	0	1.0	5	6.20	4.8	0.8	0	14	0	10	Passable
545994	Coquitlam	Yes	0.50	5	0	0	2.0	5	6.20	6.5	1.0	3	35	6	19	Potential
545996	Coquitlam	Yes	0.60	5	0	0	0.5	0	6.20	4.4	0.7	0	33	6	11	Passable
545997	Coquitlam	No		10	0	0	1.0	5	9.30	5.0	0.5	0	44	6	21	Barrier
545998	Coquitlam	No		10	0	0	1.0	5	3.10	1.4	0.5	0	99	6	21	Barrier
546002	Coquitlam	Yes	0.45	5	0	0	1.0	5	9.30	4.1	0.4	0	12	0	10	Passable
546008	Pitt	Yes	0.40	5	0	0	0.0	0	3.40	3.4	1.0	3	15	3	11	Passable
546035	Blaney	Yes	0.30	5	0	0	0.0	0	2.50	2.5	1.0	3	12	0	8	Passable
546043	Alouette	No		10	0.45	10	4.0	10	0.60	2.2	3.7	6	14	0	36	Barrier
546061	Alouette	No		10	0.45	10	3.0	10	3.40	7.0	2.1	6	26	3	39	Barrier
546067	Alouette	No		10	0.25	5	2.0	5	0.90	2.2	2.4	6	30	6	32	Barrier
546076	Lagace	No		10	0.11	0	2.0	5	1.50	6.6	4.4	6	13	0	21	Barrier
546082	Katzie	Yes		0	0	0	0.0	0	2.80	2.8	1.0	3	20	3	6	Passable
546084	N. Alouette	Yes	0.30	5	0	0	0.0	0	2.00	2.0	1.0	3	14	0	8	Passable
546086	Blaney	No		10	0.23	5	3.0	10	1.20	3.4	2.8	6	14	0	31	Barrier
546089	Lagace	No		10	0.4	10	3.0	10	0.60	3.4	5.7	6	15	3	39	Barrier
546095	Pitt	Yes	1.00	0	0	0	0.0	0	3.90	3.9	1.0	3	16	3	6	Passable
546098	Katzie	Yes	0.30	5	0	0	0.0	0	2.8	2.8	1.0	3	20	3	11	Passable
546109	Lagace	No		10	0	0	0.0	0	0.55	1.8	3.3	6	17	3	19	Potential
546118	Alouette	No		10	0.75	10	4.0	10	0.80	2.5	3.1	6	36	6	42	Barrier
546122	Lagace	No		10	0.08	0	2.0	5	1.20	1.8	1.5	6	17	3	24	Barrier
546130	Katzie	Yes	0.30	5	0	0	0.0	0	2.70	2.7	1.0	3	14	0	8	Passable
546132	N. Alouette	No		10	0.17	5	10.0	10	0.45	1.1	2.4	6	16	3	34	Barrier
546155	Lagace	No		10	0	0	0.0	0	2.30	6.6	2.9	6	2	0	16	Potential
546168	Kanaka	No		10	0.47	10	4.0	10	1.00	2.6	2.6	6	21	3	39	Barrier

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
546172	Katzie	Yes	0.30	5	0	0	0.0	0	1.60	1.0	0.6	0	13	0	5	Passable
546173	Lagace	No		10	0	0	0.0	0	2.50	6.3	2.5	6	19	3	19	Potential
546178	N. Alouette	Yes	0.15	5	0	0	1.0	5	1.10	2.8	2.5	6	20	3	19	Potential
546179	N. Alouette	No		10	0	0	4.0	10	1.10	1.8	1.6	6	26	3	29	Barrier
546184	Stave	No		10	0.5	10	3.0	10	0.90	2.7	3.0	6	25	3	39	Barrier
546194	Katzie	Yes	0.30	5	0	0	0.0	0	1.60	1.6	1.0	3	13	0	8	Passable
546197	Stave	No		10	0.16	5	2.0	5	1.20	2.1	1.8	6	14	0	26	Barrier
546205	Katzie	No		10	0	0	0.0	0	0.70	2.5	3.6	6	7	0	16	Potential
546207	N. Alouette	Yes	0.20	5	0	0	0.0	0	1.5	1.5	1.0	3	18	3	11	Passable
546208	Katzie	No		10	0.05	0	5.0	10	0.60	0.9	1.4	6	13	0	26	Barrier
546218	Katzie	Yes		0	0	0	0.0	0	1.20	3.0	2.5	6	15	3	9	Passable
546222	Stave	No		10	0.3	10	3.0	10	0.90	4.9	5.4	6	15	3	39	Barrier
546224	Kanaka	No		10	0.24	5	2.5	5	1.00	3.3	3.3	6	18	3	29	Barrier
546225	Alouette	No		10	1.5	10	3.0	10	1.10	3.0	2.7	6	14	0	36	Barrier
546227	Stave	No		10	0.4	10	0.5	0	1.80	4.0	2.2	6	35	6	32	Barrier
546241	Alouette	No		10	0.35	10	3.0	10	0.70	0.7	1.0	3	8	0	33	Barrier
546242	Alouette	No		10	0.1	0	2.0	5	1.20	2.3	1.9	6	34	6	27	Barrier
546243	Stave	No		10	0	0	2.0	5	1.00	3.5	3.5	6	18	3	24	Barrier
546248	Stave	No		10	0.02	0	0.5	0	0.95	3.1	3.3	6	28	3	19	Potential
546250	Stave	No		10	0.15	5	0.3	0	0.90	4.4	4.9	6	22	3	24	Barrier
546254	Stave	No		10	0	0	0.0	0	1.20	4.2	3.5	6	10	0	16	Potential
546257	Stave	No		10	0.6	10	5.0	10	1.50	8.0	5.3	6	30	6	42	Barrier
546263	Stave	No		10	1.5	10	6.0	10	0.60	3.0	5.0	6	8	0	36	Barrier
546270	Stave	No		10	0	0	1.0	5	3.30	7.3	2.2	6	20	3	24	Barrier
546277	Alouette	No		10	0	0	0.0	0	0.40	0.4	1.0	3	14	0	13	Passable
546278	Coquitlam	No		10	0	0	2.5	5	3.30	4.0	1.2	3	35	6	24	Barrier
546283	Coquitlam	Yes	0.40	5	0	0	0.5	0	2.30	2.4	1.0	3	14	0	8	Passable
546285	Stave	No		10	0	0	0.5	0	0.60	1.5	2.5	6	15	3	19	Potential

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
546287	Alouette	Yes	0.10	5	0	0	0.0	0	1.30	4.2	3.2	6	12	0	11	Passable
546290	Alouette	No		10	0	0	2.0	5	0.75	2.0	2.7	6	23	3	24	Barrier
546297	Alouette	Yes	0.10	5	0	0	-2.0	0	2.70	3.7	1.4	6	14	0	11	Passable
546303	Stave	No		10	0	0	0.4	0	0.80	2.5	3.1	6	18	3	19	Potential
546304	Katzie	No		10	0	0	0.0	0	0.90	0.9	1.0	3	13	0	13	Passable
546309	Alouette	No		10	0	0	2.0	5	0.40	0.5	1.3	3	14	0	18	Potential
546313	Lagace	Yes	0.05	5	0	0	0.0	0	0.77	1.6	2.1	6	9	0	11	Passable
546314	Lagace	No		10	0	0	1.0	5	1.20	3.7	3.1	6	13	0	21	Barrier
546316	Lagace	Yes	0.10	5	0	0	0.0	0	2.00	3.2	1.6	6	14	0	11	Passable
546319	Lagace	No		10	0	0	0.5	0	0.90	2.7	3.0	6	13	0	16	Potential
546321	Alouette	Yes	0.30	5	0	0	0.5	0	6.00	1.1	0.2	0	6	0	5	Passable
546328	Pitt	Yes	0.20	5	0	0	0.5	0	6.30	6.3	1.0	3	35	6	14	Passable
546334	Stave	No		10	0	0	0.1	0	3.00	7.0	2.3	6	15	3	19	Potential
546336	Alouette	Yes	0.30	5	0	0	0.5	0	3.00	1.1	0.4	0	12	0	5	Passable
546338	Lagace	Yes	0.10	5	0	0	1.0	5	0.90	4.3	4.8	6	14	0	16	Potential
546343	Alouette	Yes	0.30	0	0	0	0.5	0	1.10	1.3	1.2	3	18	3	6	Passable
546345	Alouette	No		10		0	1.0	5	1.00	3.0	3.0	6	38	6	27	Barrier
546350	Alouette	No		10	0	0	1.5	5	0.90	1.7	1.9	6	19	3	24	Barrier
546351	Kanaka	No		10	0	0	2.0	5	2.60	4.0	1.5	6	8	0	21	Barrier
546356	Pitt	No		10	0	0	3.5	10	1.20	2.8	2.3	6	25	3	29	Barrier
546357	Lagace	No		10	0	0	0.5	0	2.35	5.9	2.5	6	13	0	16	Potential
546366	Kanaka	No		10	0	0	1.0	5	2.00	5.8	2.9	6	26	3	24	Barrier
546373	Stave	No		10	0	0	1.5	5	0.80	2.7	3.4	6	12	0	21	Barrier
546374	Pitt	Yes	0.30	5	0	0	0.5	0	2.10	2.8	1.3	6	10	0	11	Passable
546378	Alouette	Yes	0.30	5	0	0	0.0	0	3.00	3.0	1.0	3	14	0	8	Passable
546380	Stave	No		10	1.2	10	3.0	10	0.90	3.4	3.8	6	25	3	39	Barrier
546381	Stave	No		10	0	0	0.0	0	1.10	4.2	3.8	6	11	0	16	Potential
546383	Alouette	No		10	0	0	0.0	0	1.30	3.0	2.3	6	38	6	22	Barrier

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
546384	Alouette	No		10	0	0	0.5	0	0.80	2.7	3.4	6	30	6	22	Barrier
546389	Stave	Yes	0.15	5	0	0	0.0	0	2.50	7.0	2.8	6	15	3	14	Passable
546390	Pitt	Yes	0.15	5	0	0	0.5	0	3.60	3.7	1.0	3	30	6	14	Passable
546393	Alouette	No		10	0	0	1.0	5	0.50	0.5	1.0	3	12	0	18	Potential
546395	Alouette	No		10		0	3.0	10	0.50	2.0	4.0	6	30	6	32	Barrier
546396	Kanaka	No		10	0	0	3.0	10	2.00	7.5	3.8	6	12	0	26	Barrier
546397	Alouette	No		10		0	3.0	10	0.80	2.0	2.5	6	80	6	32	Barrier
546398	Alouette	No		10	0.17	5	3.0	10	1.20	1.5	1.3	3	20	3	31	Barrier
546400	Alouette	No		10	0.15	5	2.0	5	1.50	2.2	1.5	6	18	3	29	Barrier
546402	Alouette	No		10	0	0	1.0	5	1.30	1.5	1.2	3	28	3	21	Barrier
546405	Pitt	No	0.30	10	0	0	1.5	5	3.60	2.3	0.6	0	30	6	21	Barrier
546408	Stave	No		10	0.1	0	3.0	10	0.90	2.5	2.8	6	25	3	29	Barrier
546409	Alouette	No		10	0.35	10	3.0	10	1.25	3.3	2.6	6	40	6	42	Barrier
546412	Stave	No		10	0.57	10	5.0	10	1.20	3.1	2.6	6	25	3	39	Barrier
546426	N. Fraser	No		10	0	0	1.0	5	3.40	8.0	2.4	6	25	3	24	Barrier
546427	Stave	No		10	0	0	1.0	5	1.60	6.2	3.9	6	30	6	27	Barrier
546429	Alouette	Yes	0.30	0	0	0	0.5	0	1.10	1.1	1.0	3	45	6	9	Passable
546433	Kanaka	No		10	0.15	5	1.0	5	6.60	9.0	1.4	6	26	3	29	Barrier
546435	Kanaka	No		10	0.7	10	1.5	5	8.00	11.5	1.4	6	28	3	34	Barrier
546436	Stave	No		10	0.3	10	1.0	5	1.20	1.9	1.6	6	15	3	34	Barrier
546440	Kanaka	No		10	0	0	1.0	5	2.70	4.6	1.7	6	18	3	24	Barrier
546449	Stave	No		10	0.3	10	2.0	5	0.90	5.0	5.6	6	10	0	31	Barrier
546451	Stave	No		10	0.9	10	2.0	5	0.6	2.5	4.2	6	15	3	34	Barrier
546458	Kanaka	Yes	0.20	5	0	0	1.5	5	1.80	3.1	1.7	6	33	6	22	Barrier
546460	Hatzic	No	0.20	10	0	0	0.5	0	1.10	2.3	2.1	6	19	3	19	Potential
546473	Hatzic	No	0.25	10	0	0	2.0	5	1.10	1.1	1.0	3	14	0	18	Potential
546478	Alouette	Yes	0.30	5	0	0	1.0	5	2.20	2.8	1.3	3	26	3	16	Potential
546480	Kanaka	Yes	1.00	5	0	0	0.0	0	9.00	3.1	0.3	0	11	0	5	Passable

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
546482	Kanaka	No		10	0.48	10	4.0	10	0.80	2.1	2.6	6	34	6	42	Barrier
546483	Stave	No		10	0.3	10	3.0	10	1.00	1.5	1.5	6	12	0	36	Barrier
546484	Katzie	Yes	0.30	0	0	0	0.1	0	1.40	1.4	1.0	3	19	3	6	Passable
546485	Alouette	No		10	0	0	6.0	10	1.10	2.4	2.2	6	55	6	32	Barrier
546488	Kanaka	No		10	0	0	0.5	0	3.05	9.7	3.2	6	20	3	19	Potential
546490	Katzie	Yes	0.80	0	0	0	0.1	0	2.40	2.4	1.0	3	26	3	6	Passable
546495	N. Fraser	No		10		0		0	0.90	2.3	2.6	6	50	6	22	Barrier
546497	Hatzic	No		10	0	0	4.0	10	1.50	2.8	1.9	6	14	0	26	Barrier
546504	N. Fraser	No		10	0	0	4.0	10	0.75	1.5	2.0	6	25	3	29	Barrier
546505	Stave	No		10	2.5	10	2.5	5	0.80	1.8	2.3	6	15	3	34	Barrier
546506	N. Fraser	No		10	0.6	10	1.0	5	3.20	7.5	2.3	6	18	3	34	Barrier
546509	Hatzic	No		10	0	0	0.0	0	0.80	0.8	1.0	3	12	0	13	Passable
546510	Kanaka	No		10	0.23	5	1.5	5	0.90	3.2	3.6	6	39	6	32	Barrier
546512	Hatzic	No		10	0.5	10	4.0	10	1.50	3.5	2.3	6	12	0	36	Barrier
546514	N. Fraser	No		10	0	0	4.0	10	1.20	2.6	2.2	6	50	6	32	Barrier
546515	N. Fraser	No		10	0	0	4.0	10	0.80	2.2	2.8	6	18	3	29	Barrier
546516	Kanaka	No		10	0.23	5	1.5	5	1.83	6.8	3.7	6	18	3	29	Barrier
546517	Hatzic	No		10	0	0	3.0	10	0.45	1.5	3.3	6	13	0	26	Barrier
546519	Kanaka	No		10	0.1	0	0.5	0	1.70	3.3	1.9	6	12	0	16	Potential
546522	Stave	No		10	1.4	10	1.0	5	1.20	2.5	2.1	6	25	3	34	Barrier
546524	Stave	No		10	0	0	0.3	0	0.80	2.3	2.9	6	25	3	19	Potential
546525	Stave	No		10	0	0	0.5	0	0.50	2.3	4.6	6	80	6	22	Barrier
546526	Kanaka	No		10	0.1	0	0.5	0	1.00	3.4	3.4	6	38	6	22	Barrier
546527	Kanaka	No		10	0.26	5	4.0	10	0.88	2.0	2.3	6	16	3	34	Barrier
546530	N. Fraser	No		10	0	0	0.0	0	0.80	1.8	2.3	6	7	0	16	Potential
546532	Kanaka	No		10	0.53	10	1.0	5	0.95	1.0	1.0	3	16	3	31	Barrier
546539	Kanaka	No		10	0	0	0.0	0	2.40	2.6	1.1	3	36	6	19	Potential
546540	Stave	No		10	1	10	14.0	10	1.10	4.5	4.1	6	25	3	39	Barrier

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
546541	Stave	No		10	0.2	5	7.0	10	1.10	4.5	4.1	6	12	0	31	Barrier
546550	N. Fraser	No		10	0.1	0	1.0	5	0.90	0.8	0.9	0	11	0	15	Potential
546551	Kanaka	Yes	0.40	5	0	0	0.5	0	3.60	3.8	1.1	3	9	0	8	Passable
546553	Kanaka	No		10	0.23	5	1.5	5	0.90	2.4	2.7	6	19	3	29	Barrier
546554	Kanaka	Yes	0.20	5	0	0	0.0	0	0.90	2.6	2.9	6	12	0	11	Passable
546555	Kanaka	No		10	0.5	10	3.0	10	1.25	2.6	2.1	6	30	6	42	Barrier
546561	Kanaka	Yes	0.50	0	0	0	0.0	0	1.00	1.6	1.6	6	9	0	6	Passable
546568	Kanaka	No		10	0.77	10	4.0	10	1.10	2.6	2.4	6	13	0	36	Barrier
546570	Kanaka	No		10	2	10	5.0	10	0.76	3.1	4.1	6	20	3	39	Barrier
546575	Stave	No		10	0.8	10	1.0	5	0.80	3.6	4.5	6	20	3	34	Barrier
546576	Kanaka	No		10	0	0	3.0	10	0.45	0.7	1.6	6	17	3	29	Barrier
546577	Kanaka	Yes	0.25	5	0	0	2.0	5	2.40	2.0	0.8	0	23	3	13	Passable
546578	Stave	Yes	0.10	5	0	0	0.0	0	1.00	3.2	3.2	6	11	0	11	Passable
546580	N. Fraser	No		10	0.23	5	1.0	5	0.80	2.1	2.6	6	11	0	26	Barrier
546583	Stave	No		10	0	0	0.1	0	0.40	2.8	7.0	6	15	3	19	Potential
546584	Kanaka	No	0.30	10	0	0	0.5	0	0.64	0.8	1.3	3	41	6	19	Potential
546587	Hatzic	No		10	0	0	0.0	0	1.20	1.2	1.0	3	15	3	16	Potential
546588	N. Fraser	No		10	0.45	10	1.0	5	3.10	4.1	1.3	6	25	3	34	Barrier
546590	N. Fraser	No		10	0.12	0	2.5	5	1.00	2.3	2.3	6	16	3	24	Barrier
546591	N. Fraser	No		10	0.39	10	0.5	0	1.26	4.2	3.3	6	10	0	26	Barrier
546599	Kanaka	No		10	0	0	0.0	0	1.70	4.4	2.6	6	16	3	19	Potential
546600	Stave	No		10	0.15	5	0.2	0	2.00	5.4	2.7	6	15	3	24	Barrier
546602	Kanaka	No		10	0	0	0.5	0	1.20	2.9	2.4	6	26	3	19	Potential
546615	Hatzic	No		10	0.4	10	3.0	10	0.80	2.5	3.1	6	16	3	39	Barrier
546616	N. Fraser	No		10	0	0	2.0	5	1.60	4.4	2.8	6	25	3	24	Barrier
546625	Kanaka	No		10	0	0	0.5	0	0.95	1.8	1.9	6	18	3	19	Potential
546627	Kanaka	Yes		0	0	0	0.0	0	1.70	2.9	1.7	6	18	3	9	Passable
546633	Kanaka	Yes	0.50	0	0	0	0.0	0	1.70	1.7	1.0	3	15	3	6	Passable

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
546643	Hatzic	No		10	0.3	10	3.0	10	1.20	4.6	3.8	6	15	3	39	Barrier
546644	Stave	Yes	0.2	5	0	0	0.0	0	2.00	5.0	2.5	6	11	0	11	Passable
546654	Stave	No		10	0	0	0.0	0	1.80	4.6	2.5	6	22	3	19	Potential
546661	Stave	No		10	0	0	0.5	0	0.50	3.2	6.3	6	18	3	19	Potential
546665	Hatzic	No		10	1.1	10	6.0	10	0.90	1.5	1.7	6	22	3	39	Barrier
546666	N. Fraser	Yes	0.20	5	0	0	0.0	0	0.40	0.9	2.3	6	25	3	14	Passable
546667	N. Fraser	Yes	0.40	5	0	0	0.2	0	2.10	4.0	1.9	6	18	3	14	Passable
546680	N. Fraser	No		10		0	4.0	10	0.43	0.4	0.9	0	15	3	23	Barrier
546682	N. Fraser	No		10	0	0	3.0	10	1.50	2.7	1.8	6	24	3	29	Barrier
546685	N. Fraser	No		10	3.1	10	3.0	10	1.20	3.5	2.9	6	22	3	39	Barrier
546691	N. Fraser	No		10	0	0	0.5	0	1.80	6.2	3.4	6	12	0	16	Potential
546697	N. Fraser	No		10	0	0	1.0	5	1.30	2.0	1.5	6	42	6	27	Barrier
546699	N. Fraser	No		10	0.4	10	1.0	5	3.80	3.8	1.0	3	21	3	31	Barrier
546702	Stave	Yes	0.2	5	0	0	0.0	0	2.00	1.4	0.7	0	11	0	5	Passable
546707	N. Fraser	Yes	0.40	0	0	0	0.5	0	0.85	1.5	1.8	6	9	0	6	Passable
546710	N. Fraser	Yes	0.20	5	0	0	0.0	0	1.70	1.4	0.8	0	14	0	5	Passable
546711	Stave	No		10	0.25	5	0.2	0	0.90	1.4	1.6	6	18	3	24	Barrier
546722	N. Fraser	No		10	0.65	10	1.0	5	1.90	4.8	2.5	6	11	0	31	Barrier
546728	Hatzic	No		10	0	0	0.0	0	1.10	2.6	2.4	6	18	3	19	Potential
546732	Hatzic	No		10	0.25	5	2.0	5	2.00	3.9	2.0	6	17	3	29	Barrier
546734	Hatzic	No		10	0	0	0.0	0	0.80	2.3	2.8	6	13	0	16	Potential
546738	N. Fraser	No		10	0	0	2.0	5	3.90	6.4	1.6	6	25	3	24	Barrier
546740	N. Fraser	No		10	0.36	10	2.0	5	2.60	4.0	1.5	6	28	3	34	Barrier
546745	Stave	No		10	1.8	10	2.0	5	0.90	2.2	2.5	6	18	3	34	Barrier
546750	Stave	No		10	0	0	0.1	0	0.80	1.4	1.8	6	12	0	16	Potential
546753	N. Fraser	No		10	0.84	10	1.0	5	1.00	2.9	2.9	6	22	3	34	Barrier
546756	N. Fraser	No		10	4	10	4.0	10	1.00	2.4	2.4	6	40	6	42	Barrier
546758	Stave	No		10	0	0	0.1	0	0.90	1.7	1.9	6	10	0	16	Potential

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
546761	N. Fraser	Yes	0.50	0	0	0	0.5	0	1.20	2.0	1.7	6	38	6	12	Passable
546764	Stave	No		10	0.25	5	5.0	10	0.90	1.4	1.6	6	18	3	34	Barrier
546767	N. Fraser	No		10	0.3	10	3.0	10	0.60	2.4	4.0	6	40	6	42	Barrier
546772	Stave	No		10	0.75	10	3.0	10	1.50	2.1	1.4	6	20	3	39	Barrier
546780	N. Fraser	No		10	0.2	5	4.0	10	1.20	2.5	2.1	6	12	0	31	Barrier
546802	Hatzic	No		10	9.99	10	5.0	10	2.50	8.0	3.2	6	20	3	39	Barrier
546808	Hatzic	Yes	0.30	0	0	0	0.0	0	1.00	1.0	1.0	3	11	0	3	Passable
546817	Hatzic	No		10	0.3	10	1.0	5	2.40	8.5	3.5	6	15	3	34	Barrier
546825	Hatzic	Yes	0.30	0	0	0	0.0	0	0.90	0.9	1.0	3	28	3	6	Passable
546846	N. Fraser	No		10	0.25	5	2.5	5	1.00	1.5	1.5	6	14	0	26	Barrier
546859	N. Fraser	No		10	0	0	3.5	10	0.90	3.8	4.2	6	19	3	29	Barrier
546862	N. Fraser	No		10	0	0	4.0	10	1.20	3.2	2.7	6	33	6	32	Barrier
546882	N. Fraser	Yes	0.25	5	0.04	0	3.0	10	2.40	1.9	0.8	0	32	6	21	Barrier
545681B	Alouette	No		10	1.1	10	3.0	10	1.40	4.0	2.9	6	15	3	39	Barrier
546173B	Lagace	Yes	0.10	5	0	0	0.0	0	2.40	6.8	2.8	6	15	3	14	Passable
546530B	N. Fraser	No		10	0	0	0.0	0	0.90	1.3	1.4	6	7	0	16	Potential
546666B	N. Fraser	No		10	0	0	1.0	5	0.25	0.7	2.8	6	18	3	24	Barrier
546738A	N. Fraser	Yes	0.30	5	0	0	0.5	0	4.00	1.1	0.3	0	10	0	5	Passable
546740A	N. Fraser	Yes	0.50	5	0	0	0.0	0	4.00	1.7	0.4	0	12	0	5	Passable
546756A	N. Fraser	No		10	4	10	3.0	10	1.20	2.5	2.1	6	12	0	36	Barrier
CBC101	N. Fraser	No		10	0.05	0	0.5	0	1.80	2.6	1.4	6	18	3	19	Potential
CV1	Stave	No		10	0	0	3.0	10	0.95	2.7	2.8	6	6	0	26	Barrier
CV10	Pitt	Yes	0.30	0	0	0	8.0	10	1.20	1.7	1.4	6	17	3	19	Potential
CV101	Stave	Yes	0.12	5	0	0	0.0	0	1.3	3.5	2.7	6	12	0	11	Passable
CV102	Stave	No		10	0.2	5	6.0	10	1.00	3.3	3.3	6	13	0	31	Barrier
CV109	Kanaka	No		10	0	0	1.5	5	0.96	3.1	3.2	6	20	3	24	Barrier
CV11	Pitt	Yes	0.35	0	0	0	5.0	10	1.50	2.6	1.7	6	17	3	19	Potential
CV110	Kanaka	No		10	0	0	0.5	0	1.20	2.3	1.9	6	20	3	19	Potential

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
CV111	Kanaka	No		10	0	0	1.0	5	0.75	3.7	4.9	6	8	0	21	Barrier
CV112	Kanaka	No		10	0	0	1.0	5	1.10	3.0	2.7	6	15	3	24	Barrier
CV113	Kanaka	No		10	0.2	5	4.0	10	0.76	2.7	3.6	6	17	3	34	Barrier
CV12	Hatzic	Yes	0.30	5	0	0	0.0	0	1.60	1.6	1.0	3	25	3	11	Passable
CV13	Hatzic	Yes	0.30	5	0	0	0.0	0	2.30	2.3	1.0	3	7	0	8	Passable
CV14	N. Alouette	No		10	0	0	1.0	5	1.00	1.0	1.0	3	20	3	21	Barrier
CV15	Pitt	Yes	0.20	5	0	0	0.0	0	1.30	1.3	1.0	3	16	3	11	Passable
CV16	Pitt	Yes	0.30	5	0	0	0.0	0	1.90	1.9	1.0	3	30	6	14	Passable
CV17	Pitt	Yes	0.30	0	0	0	0.0	0	1.30	1.3	1.0	3	25	3	6	Passable
CV2	Alouette	Yes	0.05	5	0	0	2.0	5	0.40	0.5	1.3	3	6	0	13	Passable
CV20	Widgeon	No		10	0	0	0.5	0	0.70	1.8	2.6	6	4	0	16	Potential
CV21	Pitt	Yes	0.50	5	0	0	0.0	0	3.70	2.8	0.8	0	12	0	5	Passable
CV22	Pitt	Yes	0.80	0	0	0	15.0	10	3.00	1.9	0.6	0	20	3	13	Passable
CV23	Pitt	Yes	0.80	0	0	0	11.0	10	3.00	1.8	0.6	0	23	3	13	Passable
CV24	Pitt	Yes	0.50	0	0	0	3.0	10	1.80	1.7	0.9	0	14	0	10	Passable
CV25	Pitt	No		10	0	0	0.5	0	3.70	5.0	1.4	6	28	3	19	Potential
CV27	Pitt	Yes	0.30	0	0	0	0.5	0	1.20	1.8	1.5	6	5	0	6	Passable
CV28	Coquitlam	Yes	0.40	5	0	0	0.5	0	2.40	2.4	1.0	3	14	0	8	Passable
CV29	Katzie	Yes	0.30	5	0	0	0.5	0	2.20	2.2	1.0	3	24	3	11	Passable
CV3	Alouette	No		10	0.08	0	0.5	0	0.40	1.0	2.5	6	4	0	16	Potential
CV30	Katzie	Yes	0.10	5	0	0	0.5	0	1.70	1.7	1.0	3	17	3	11	Passable
CV31	Katzie	Yes	0.10	5	0	0	0.5	0	1.50	1.5	1.0	3	16	3	11	Passable
CV32	Katzie	Yes	0.30	5	0	0	0.0	0	5.40	5.4	1.0	3	12	0	8	Passable
CV33	N. Fraser	No		10	0	0	0.0	0	2.50	2.5	1.0	3	22	3	16	Potential
CV4	Alouette	No		10	0.65	10	8.0	10	0.60	2.5	4.2	6	16	3	39	Barrier
CV401	Kanaka	No		10	0	0	3.0	10	0.60	1.6	2.7	6	25	3	29	Barrier
CV402	Kanaka	No		10	0.69	10	2.5	5	0.65	1.3	2.0	6	38	6	37	Barrier
CV403	Coquitlam	No		10	0	0	0.1	0	0.50	1.1	2.2	6	50	6	22	Barrier

Site ID	Watershed	Embedded	Depth Embedded	Value	Outlet drop	Value	Culvert Slope	Value	Culvert Diameter	Stream Width	SWR	Value	Length	Value	Cumulative Score	Result
CV404	Coquitlam	No		10	0.12	0	2.5	5	1.20	2.4	2.0	6	18	3	24	Barrier
CV405	Coquitlam	No		10	0	0	7.0	10	0.60	2.0	3.3	6	18	3	29	Barrier
CV406	Coquitlam	No		10	0	0	10.0	10	0.40	1.7	4.3	6	12	0	26	Barrier
CV407	Coquitlam	No		10	0	0	10.0	10	0.30	1.4	4.7	6	16	3	29	Barrier
CV408	Coquitlam	No		10	0.44	10	5.0	10	0.75	1.4	1.9	6	8	0	36	Barrier
CV409	Coquitlam	No		10	0.4	10	2.0	5	1.40	1.8	1.3	3	99	6	34	Barrier
CV410	Coquitlam	No		10	0	0	0.2	0	1.80	1.8	1.0	3	7	0	13	Passable
CV411	Coquitlam	Yes	0.40	5	0	0	0.2	0	2.70	4.0	1.5	6	11	0	11	Passable
CV412	Coquitlam	Yes	0.20	5	0.1	0	0.5	0	1.80	4.5	2.5	6	12	0	11	Passable
CV5	Alouette	No		10	0	0	0.5	0	1.10	2.4	2.2	6	13	0	16	Potential
CV6	Alouette	No		10	0.92	10	2.0	5	0.60	2.2	3.7	6	8	0	31	Barrier
CV7	Alouette	No		10	1.09	10	1.0	5	1.00	2.0	2.0	6	8	0	31	Barrier
CV8	Pitt	No		10	0.77	10	2.5	5	0.60	2.7	4.5	6	8	0	31	Barrier
CV9	Pitt	No		10	0.43	10	4.0	10	1.00	2.0	2.0	6	9	0	36	Barrier

APPENDIX 4

Field Data and Photographs of High and Moderate Priority Crossings

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Stave
Crossing ID#:	302
PCIS Crossing ID:	
Date:	27/10/2011
Crew:	IdZ / JC
UTM:	10.546129.5448025
Stream:	Hairsine
Road:	Keystone 2.9 km
Road Tenure:	Urban

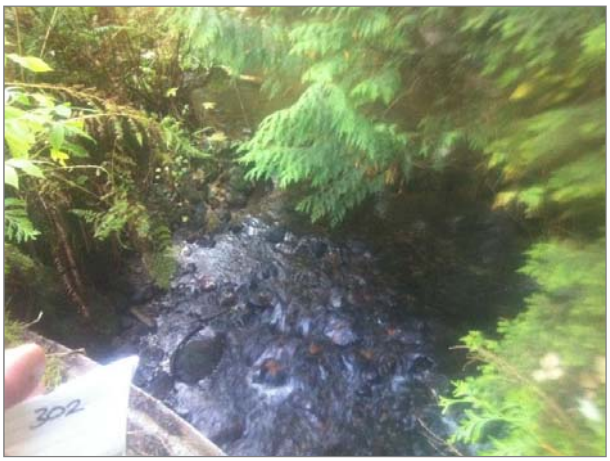
Stream Information	
Channel Width:	5.37 m
Stream Slope:	0.5 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	2 m x 20 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	Yes
Percent Backwatered:	
Fill Depth:	1.5 m
Outlet Drop:	0 m
Outlet Pool Depth:	0.3 m
Inlet Drop:	No
Culvert Slope:	0.3 %
Barrier Result:	Potential
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Fish presence not confirmed. May not be a barrier to larger fish. Harisine provides good habitat. Looks like it might be more backwatered at higher flows. Appears to be large enough for storm flows plus capacity for internal works for streambed bedload retention. Candidate for outlet works to ensure backwatering.

302



Upstream View

Downstream View

Outlet

Inlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Stave
Crossing ID#:	310
PCIS Crossing ID:	
Date:	29/10/2011
Crew:	IdZ / JC
UTM:	10.550743.5455070
Stream:	Trib to Cardinalis
Road:	Sabo Road
Road Tenure:	RP
Stream Information	
Channel Width:	2.1 m
Stream Slope:	4 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Shallow Fill
Habitat Value:	Medium

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	1 m x 14 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	1 m
Outlet Drop:	0.4 m
Outlet Pool Depth:	0.3 m
Inlet Drop:	No
Culvert Slope:	0 %
Barrier Result:	Barrier
Culvert Fix:	Open Bottom Structure
Fix Span / Diameter:	1.20

Comments:

Spawning gravels present. Nice little stream. Not sure where it comes from. Road is downhill, north-facing with a turn immediately after the crossing, dangerous for bridge due to icing.

310

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Coquitlam
Crossing ID#:	545770
PCIS Crossing ID:	
Date:	17/11/2011
Crew:	AI / JC
UTM:	10.513782.5462074
Stream:	Scott Cr
Road:	Eagle Mountain Dr
Road Tenure:	3486447
Stream Information	
Channel Width:	1.5 m
Stream Slope:	12 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	Medium

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	2.6 m x 28 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	1.2 m
Outlet Drop:	0.5 m
Outlet Pool Depth:	0.2 m
Inlet Drop:	Yes
Culvert Slope:	1.5 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Good habitat. Small woody debris, deep pools and gravels abundant downstream. Upstream is beaver pond with dam immediately upstream of inlet. Inlet drop is 2 m high. Needs repair. Candidate for outlet pond works with fish passage pools and drops/jumps installed.

545770

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Coquitlam
Crossing ID#:	545835
PCIS Crossing ID:	
Date:	17/11/2011
Crew:	AI / JC
UTM:	10.513674.5461070
Stream:	Scott Cr
Road:	Tanglewood Lane
Road Tenure:	4222804
Stream Information	
Channel Width:	4.8 m
Stream Slope:	1.5 %
Beaver Activity:	Yes
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Concrete Box
Culvert Dimensions:	4.8 m x 35 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	5 m
Outlet Drop:	0.6 m
Outlet Pool Depth:	0.45 m
Inlet Drop:	No
Culvert Slope:	5 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Excellent habitat. Step-pool boulder morphology. Abundant deep pools, boulder cover, undercut banks and overhanging vegetation. Baffled structure with outlet controls. Drop at outlet is barrier to small fish. Structure has baffles. Could make one culvert accessible to fish, the other for stormflow water flows (dedicated flow side). Candidate for outlet weir works and substrate addition.

545835

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Alouette
Crossing ID#:	545983
PCIS Crossing ID:	
Date:	28/10/2011
Crew:	SM / JC
UTM:	10.533991.5457845
Stream:	Mike Lake Cr
Road:	Mike Lake Road 1.6 km
Road Tenure:	3251524

Stream Information	
Channel Width:	6 m
Stream Slope:	12 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	1.8 m x 20 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	1 m
Outlet Drop:	0.5 m
Outlet Pool Depth:	0.4 m
Inlet Drop:	No
Culvert Slope:	3 %
Barrier Result:	Barrier
Culvert Fix:	Open Bottom Structure
Fix Span / Diameter:	6.00

Comments:

Excellent habitat upstream, lower gradients at 5%. Gradient great downstream at 12 %. Abundant cover, but little gravel. Looks like newer culvert. Stream is too steep for any treatments or open bottom arch type of replacement. Candidate for steel bridge, likely 6 meter span on 2M substructure.

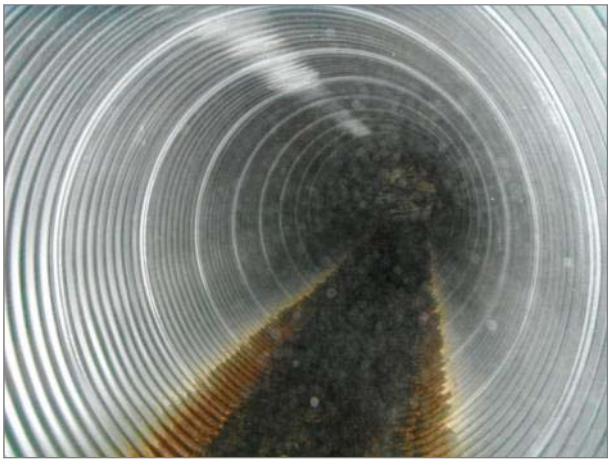
545983

Upstream View

Downstream View

Inlet

Outlet



Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Alouette
Crossing ID#:	546061
PCIS Crossing ID:	
Date:	28/10/2011
Crew:	SM / JC
UTM:	10.534343.5456242
Stream:	Mill Lake outflow
Road:	Golden Ears Park Rd 2 km
Road Tenure:	3976369

Stream Information	
Channel Width:	7 m
Stream Slope:	3 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Oval Culvert
Culvert Dimensions:	3.4 m x 26 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	0.8 m
Outlet Drop:	0.45 m
Outlet Pool Depth:	1.5 m
Inlet Drop:	No
Culvert Slope:	3 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Excellent habitat, deep pools, abundant cover, LWD, undercut banks. Deep pool at outflow. Candidate for streambed simulation devices along haunch, likely on one side. Addition of substrate recommended with outlet weir required for backwatering. Inlet step structure likely required due to stormflows, infilling evident and continued maintenance expected unless inlet and outlet weirs designed to accommodate natural bedload movement.

546061

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	N. Alouette
Crossing ID#:	546179
PCIS Crossing ID:	
Date:	18/11/2011
Crew:	DFK / JC
UTM:	10.531034.5454636
Stream:	Trib to N. Alouette
Road:	Balsam St
Road Tenure:	3517839

Stream Information	
Channel Width:	1.8 m
Stream Slope:	3 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	1.1 m x 25.5 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	1.5 m
Outlet Drop:	0 m
Outlet Pool Depth:	0 m
Inlet Drop:	No
Culvert Slope:	4 %
Barrier Result:	Barrier
Culvert Fix:	Open Bottom Structure
Fix Span / Diameter:	1.80

Comments:

Excellent spawning habitat. Log structures built into stream to form spawning channel upstream. Downstream is channelized with river rock. Candidate for open bottom arch 1800 X 900.

546179

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Stave
Crossing ID#:	546227
PCIS Crossing ID:	
Date:	29/10/2011
Crew:	IdZ / JC
UTM:	10.552172.5453315
Stream:	Trib to Cardinalis
Road:	Johnston Road
Road Tenure:	2219410

Stream Information	
Channel Width:	4 m
Stream Slope:	3 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	Medium

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Concrete Box
Culvert Dimensions:	1.8 m x 35 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	3 m
Outlet Drop:	0.4 m
Outlet Pool Depth:	0.2 m
Inlet Drop:	No
Culvert Slope:	0.5 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Some odd baffles present in culvert. Nice looking stream above. Good size and flow. Fish presence not confirmed. Candidate for outlet weir and substrate addition.

546227

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Stave
Crossing ID#:	546250
PCIS Crossing ID:	
Date:	27/10/2011
Crew:	IdZ / JC
UTM:	10.543369.5453401
Stream:	Phillips Creek
Road:	Hudson Ave 0.2 km
Road Tenure:	4208276

Stream Information	
Channel Width:	4.43 m
Stream Slope:	1 %
Beaver Activity:	Yes
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	Medium

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	0.9 m x 22 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	1.5 m
Outlet Drop:	0.15 m
Outlet Pool Depth:	0.5 m
Inlet Drop:	No
Culvert Slope:	0.3 %
Barrier Result:	Barrier
Culvert Fix:	Backwater
Fix Span / Diameter:	

Comments:

Beaver activity upstream, lots of rearing habitat. Several private crossings downstream. Cutthroat present downstream. Candidate for backwatering. Too small for embedment and too long. Paved road and urban setting preclude replacement early. Backwatering is a best choice for fish rehab. Alternatively, open bottom arch (2.1 x 22m).

546250

Upstream View

Downstream View

Outlet

Inlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Stave
Crossing ID#:	546270
PCIS Crossing ID:	
Date:	28/10/2011
Crew:	IdZ / JC
UTM:	10.549170.5453008
Stream:	Steelhead Creek
Road:	Dwedney Trunk
Road Tenure:	2818170

Stream Information	
Channel Width:	7.3 m
Stream Slope:	2 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Shallow Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	3.3 m x 20 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	Yes
Percent Backwatered:	
Fill Depth:	1.5 m
Outlet Drop:	0 m
Outlet Pool Depth:	5 m
Inlet Drop:	No
Culvert Slope:	1 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

May allow passage for larger fish. Crossing is Steelhead Creek. Excellent habitat. Candidate for streambed retention structures in the CBS, likely at haunches. Pipe large enough to work in safely and large enough for stormflows (P Eng to certify).

546270

Upstream View

Downstream View

Outlet

Inlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Lagace
Crossing ID#:	546314
PCIS Crossing ID:	
Date:	24/10/2011
Crew:	AI / JC
UTM:	10.555368.5453222
Stream:	Oru Creek
Road:	35559 Durieux Road
Road Tenure:	4208247

Stream Information	
Channel Width:	3.7 m
Stream Slope:	2 %
Beaver Activity:	No
Fish Sighted:	Yes
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	1.2 m x 13 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	0.4 m
Outlet Drop:	0 m
Outlet Pool Depth:	1 m
Inlet Drop:	No
Culvert Slope:	1 %
Barrier Result:	Barrier
Culvert Fix:	Open Bottom Structure
Fix Span / Diameter:	8.00

Comments:

Twin culverts passable, Chum present downstream. Discussed with neighbour, fish used to move upstream but not observed this year. Candidate for concrete panel bridge.

546314

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Stave
Crossing ID#:	546334
PCIS Crossing ID:	
Date:	29/10/2011
Crew:	IdZ / JC
UTM:	10.549753.5452359
Stream:	Steelhead Creek
Road:	Dwedney Trunk
Road Tenure:	3608911
Stream Information	
Channel Width:	7 m
Stream Slope:	0.1 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Oval Culvert
Culvert Dimensions:	3 m x 15 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	2 m
Outlet Drop:	0 m
Outlet Pool Depth:	0 m
Inlet Drop:	No
Culvert Slope:	0.1 %
Barrier Result:	Potential
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Probably passable to larger fish. Nice habitat u/s and d/s. Structure is old but remaining life of 25 years expected. Size of structure and apparent lack of high water flows due to gentle gradient make structure candidate for substrate addition and backwatering.

546334

Upstream View

Downstream View

Outlet

Inlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Kanaka
Crossing ID#:	546351
PCIS Crossing ID:	
Date:	16/11/2011
Crew:	SM / JC
UTM:	10.534835.5452902
Stream:	Trib to Kanaka Cr
Road:	124 Ave 0.2 km
Road Tenure:	4767280

Stream Information	
Channel Width:	4 m
Stream Slope:	2 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Oval Culvert
Culvert Dimensions:	2.6 m x 7.5 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	1 m
Outlet Drop:	0 m
Outlet Pool Depth:	0.55 m
Inlet Drop:	No
Culvert Slope:	2 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Excellent habitat, low gradient, abundant cover deep pools, undercut banks, and overstream vegetation. Gravel present for spawning. Electric fence downstream. Candidate for substrate installation with retaining devices or implements and backwatering. Or replace with open bottom arch (3.4 x 25 m).

546351

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Kanaka
Crossing ID#:	546366
PCIS Crossing ID:	
Date:	29/10/2011
Crew:	SM / JC
UTM:	10.538136.5452691
Stream:	Trib to Kanaka
Road:	269 St.
Road Tenure:	4775237

Stream Information	
Channel Width:	5.8 m
Stream Slope:	5 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Oval Culvert
Culvert Dimensions:	2 m x 26 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	0.75 m
Outlet Drop:	0 m
Outlet Pool Depth:	0.4 m
Inlet Drop:	Yes
Culvert Slope:	1 %
Barrier Result:	Barrier
Culvert Fix:	Open Bottom Structure
Fix Span / Diameter:	12.00

Comments:

Excellent habitat. Abundant cover in the form of boulders, deep pools, overhanging vegetation. Some pockets of gravel present. candidate for concrete panel bridge

546366

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Stave
Crossing ID#:	546427
PCIS Crossing ID:	
Date:	27/10/2011
Crew:	IdZ / JC
UTM:	10.543195.5451955
Stream:	Phillips Creek
Road:	Dwedney Trunk
Road Tenure:	4873647

Stream Information	
Channel Width:	6.2 m
Stream Slope:	3.5 %
Beaver Activity:	Yes
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	1.6 m x 30 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	Yes
Percent Backwatered:	
Fill Depth:	9.99 m
Outlet Drop:	0 m
Outlet Pool Depth:	0.2 m
Inlet Drop:	No
Culvert Slope:	1 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Beaver dam u/s at manmade rock groin. Nice ponds u/s. Cutthrout reported upstream. Candidate for backwatering. Ultimately replace with open bottom arch (3.4 x 30 m).

546427

Upstream View

Downstream View

Outlet

Inlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Kanaka Cr
Crossing ID#:	546433
PCIS Crossing ID:	
Date:	29/10/2011
Crew:	SM / JC
UTM:	10.539442.5452055
Stream:	Kanaka Cr
Road:	Dewdney Trunk
Road Tenure:	4214953
Stream Information	
Channel Width:	9 m
Stream Slope:	1 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Oval Culvert
Culvert Dimensions:	6.6 m x 26 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	2 m
Outlet Drop:	0.15 m
Outlet Pool Depth:	0.8 m
Inlet Drop:	Yes
Culvert Slope:	1 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Excellent habitat. Low gradient. Cover in the form of boulders, deep pools, overhanging vegetation. No gravels observed. Candidate for installing baffles, substrate addition and backwatering. Alternatively concrete bridge installation (12 m span).

546433

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Kanaka
Crossing ID#:	546435
PCIS Crossing ID:	
Date:	16/11/2011
Crew:	SM / JC
UTM:	10.535498.5452221
Stream:	Trib to Kanaka Cr
Road:	256 St.
Road Tenure:	4774981

Stream Information	
Channel Width:	11.5 m
Stream Slope:	1 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Oval Culvert
Culvert Dimensions:	8 m x 28 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	3 m
Outlet Drop:	0.7 m
Outlet Pool Depth:	1.25 m
Inlet Drop:	No
Culvert Slope:	1.5 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Twin culverts, 4 m each span. No fish observed but fish bearing. Excellent habitat with abundant deep pools, large woody debris, overstream vegetation. Gravel abundant for spawning. Candidate for works on the southern smaller pipe including backwater and substrate addition. Outlet weir works will be extensive due to accommodating flow in the large pipe and enabling step-pool and/or backwater weir . Alternatively, replace with bridge.

546435

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Kanaka
Crossing ID#:	546440
PCIS Crossing ID:	
Date:	16/11/2011
Crew:	SM / JC
UTM:	10.537429.5452053
Stream:	Trib to Kanaka Cr
Road:	Dewdney Trunk
Road Tenure:	4215055
Stream Information	
Channel Width:	4.6 m
Stream Slope:	1 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Oval Culvert
Culvert Dimensions:	2.7 m x 18 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	2.5 m
Outlet Drop:	0 m
Outlet Pool Depth:	0.25 m
Inlet Drop:	No
Culvert Slope:	1 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Salmon habitat sign. Excellent habitat upstream with complex habitat, large woody debris and deep pools present. Gravel present for spawning. Riparian removed downstream by property owner. Candidate for substrate installation with retaining devices or implements and backwatering.

546440

Upstream View

Downstream View

Inlet

Not Available

Outlet

Barrel

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Stave
Crossing ID#:	546449
PCIS Crossing ID:	
Date:	28/10/2011
Crew:	IdZ / JC
UTM:	10.546053.5451583
Stream:	Trib to Hayward Reservoir
Road:	Railway Trail
Road Tenure:	4197624

Stream Information	
Channel Width:	5 m
Stream Slope:	1 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Shallow Fill
Habitat Value:	Medium

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	0.9 m x 10 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	1.5 m
Outlet Drop:	0.3 m
Outlet Pool Depth:	0.5 m
Inlet Drop:	No
Culvert Slope:	2 %
Barrier Result:	Barrier
Culvert Fix:	Open Bottom Structure
Fix Span / Diameter:	1.20

Comments:

Culvert under railway trail. Stream measurements made u/s as reservoir is downstream. Spawning habitat present. Photos poor due to low light. Candidate for open bottom arch.

546449

Upstream View

Downstream View

Inlet

Not Available

Outlet

Not Available

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Hatzic
Crossing ID#:	546460
PCIS Crossing ID:	
Date:	30/10/2011
Crew:	AI / JC
UTM:	10.556012.5450959
Stream:	Trib to Hatzic Slough
Road:	11426 Sylvester
Road Tenure:	4208828
Stream Information	
Channel Width:	2.27 m
Stream Slope:	1 %
Beaver Activity:	Yes
Fish Sighted:	Yes
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	1.1 m x 19 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	Yes
Percent Backwatered:	
Fill Depth:	0.5 m
Outlet Drop:	0 m
Outlet Pool Depth:	0.65 m
Inlet Drop:	No
Culvert Slope:	0.5 %
Barrier Result:	Potential
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Abundant gravels upstream. Beaver dam backwaters culvert. Good low gradient spawning habitat. Culvert probably not passable if beaver dam removed. Crossing is a candidate for backwatering and structure is large enough for man-work to install streambed retention implements and substrate addition.

546460

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Hatzic
Crossing ID#:	546473
PCIS Crossing ID:	
Date:	30/10/2011
Crew:	AI / JC
UTM:	10.556069.5450894
Stream:	Trib to Hatzic Slough
Road:	11426 Sylvester
Road Tenure:	4208828

Stream Information	
Channel Width:	1.1 m
Stream Slope:	1 %
Beaver Activity:	Yes
Fish Sighted:	Yes
Valley Fill:	Deep Fill
Habitat Value:	Medium

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	1.1 m x 14 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	Yes
Percent Backwatered:	
Fill Depth:	0.4 m
Outlet Drop:	0 m
Outlet Pool Depth:	0.62 m
Inlet Drop:	Yes
Culvert Slope:	2 %
Barrier Result:	Potential
Culvert Fix:	Open Bottom Structure
Fix Span / Diameter:	1.40

Comments:

Ditches u/s and d/s. Backwatered by beaver dam 100m downstream, therefore adjusted SWR (Stream is 4.1 m). Low gradient. Culvert probably not passable if beaver dam removed. Further action recommended. Candidate for open bottom arch.

546473

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Alouette
Crossing ID#:	546478
PCIS Crossing ID:	
Date:	28/10/2011
Crew:	AI / JC
UTM:	10.525815.5452042
Stream:	McKenny Cr
Road:	Dewdney Trail and 208 st
Road Tenure:	4216042

Stream Information	
Channel Width:	2.8 m
Stream Slope:	1 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	Medium

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	2.2 m x 26 m
Continuous Embeddedment:	Yes
Average Depth Embedded:	0.3 m
Resemble Channel:	Yes
Backwatered:	No
Percent Backwatered:	
Fill Depth:	2.5 m
Outlet Drop:	0 m
Outlet Pool Depth:	0.15 m
Inlet Drop:	No
Culvert Slope:	1 %
Barrier Result:	Potential
Culvert Fix:	Backwater
Fix Span / Diameter:	

Comments:

Revegetation project along creek with browse protection. High volume and turbid during precipitation events. Heavily covered in vegetation. Potential for CO rearing. Embedded, difficult to determine due to high turbidity. Small size of pipes would normally preclude streambed simulation, however this site has two pipes, one of which could be a candidate for backwatering to a deeper level with a creative split-type outlet weir. Replacement structure is a 2440mm x 1270mm Open bottom arch.

546478

Upstream View

Downstream View

Inlet

Outlet

Barrel

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	N. Fraser
Crossing ID#:	546506
PCIS Crossing ID:	
Date:	29/10/2011
Crew:	SM / JC
UTM:	10.540543.5450466
Stream:	Whonnock Cr
Road:	#11237 112 Ave
Road Tenure:	4766056

Stream Information	
Channel Width:	7.5 m
Stream Slope:	7 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	3.2 m x 18 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	1 m
Outlet Drop:	0.6 m
Outlet Pool Depth:	1.5 m
Inlet Drop:	Yes
Culvert Slope:	1 %
Barrier Result:	Barrier
Culvert Fix:	Open Bottom Structure
Fix Span / Diameter:	12.00

Comments:

Excellent habitat, abundant boulder cover, deep pools. Backwatering? Road is on a Junction and slight compression curve which normally would require a open bottom arch. Stream size is a candidate for a 12M bridge on spread footings with batter walls likely 4M high.

546506

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Hatzic
Crossing ID#:	546512
PCIS Crossing ID:	
Date:	30/10/2011
Crew:	IdZ / JC
UTM:	10.553494.5449754
Stream:	Kenworthy Creek
Road:	Dale Road
Road Tenure:	4208757
Stream Information	
Channel Width:	3.5 m
Stream Slope:	1.5 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	1.5 m x 12 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	0.5 m
Outlet Drop:	0.5 m
Outlet Pool Depth:	1 m
Inlet Drop:	No
Culvert Slope:	4 %
Barrier Result:	Barrier
Culvert Fix:	Open Bottom Structure
Fix Span / Diameter:	6.00

Comments:

Large outlet pool. Nice habitat upstream. Recommend further action. Secondary culvert (0.8) dry. Candidate for concrete panel bridge.

546512

Upstream View

Downstream View

Outlet

Inlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Kanaka
Crossing ID#:	546516
PCIS Crossing ID:	
Date:	14/11/2011
Crew:	DFK / JC
UTM:	10.533338.5450534
Stream:	Dunlop Cr
Road:	112 Ave
Road Tenure:	4766042

Stream Information	
Channel Width:	6.8 m
Stream Slope:	2 %
Beaver Activity:	No
Fish Sighted:	Yes
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Concrete Box
Culvert Dimensions:	1.83 m x 18.4 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	2.5 m
Outlet Drop:	0.23 m
Outlet Pool Depth:	0.16 m
Inlet Drop:	No
Culvert Slope:	1.5 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Excellent habitat. Candidate for streambed simulation internal structures and outlet weir works consistent with internal works.

546516

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	N. Fraser
Crossing ID#:	546588
PCIS Crossing ID:	
Date:	29/10/2011
Crew:	SM / JC
UTM:	10.540938.5448867
Stream:	Trib to Whonnock Cr
Road:	104 Ave
Road Tenure:	4765162

Stream Information	
Channel Width:	4.1 m
Stream Slope:	3 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	Medium

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Oval Culvert
Culvert Dimensions:	3.1 m x 25 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	2 m
Outlet Drop:	0.45 m
Outlet Pool Depth:	0.32 m
Inlet Drop:	No
Culvert Slope:	1 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Box culvert for top part of culvert 2 m wide, last third of culvert oval metal culvert. Fix recommendation is add substrate in one of the culverts and install outlet weir.

546588

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Stave
Crossing ID#:	546600
PCIS Crossing ID:	
Date:	27/10/2011
Crew:	IdZ / JC
UTM:	10.545489.5448631
Stream:	Hairsine
Road:	Keystone 2.7 km
Road Tenure:	4208941

Stream Information	
Channel Width:	5.4 m
Stream Slope:	0.2 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Concrete Box
Culvert Dimensions:	2 m x 15 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	1.5 m
Outlet Drop:	0.15 m
Outlet Pool Depth:	0.2 m
Inlet Drop:	No
Culvert Slope:	0.2 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Looks like some small baffles in culvert. Should allow passage for larger fish. Good habitat in Harisine. Candidate for backwatering and embeddment by installing internal devices

546600

Upstream View

Not Available

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	N. Fraser
Crossing ID#:	546699
PCIS Crossing ID:	
Date:	29/10/2011
Crew:	SM / JC
UTM:	10.540559.5447549
Stream:	Trib to Whonnock Cr
Road:	280 St
Road Tenure:	4871952

Stream Information	
Channel Width:	3.8 m
Stream Slope:	2 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	Medium

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Concrete Box
Culvert Dimensions:	3.8 m x 21 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	3 m
Outlet Drop:	0.4 m
Outlet Pool Depth:	0.7 m
Inlet Drop:	No
Culvert Slope:	1 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Main cover overstream vegetation. Little deep pools. Could put baffles in culvert. Passable for larger fish. CM and CO recorded in stream. Twin box concrete culvert (2 x 1.9 m). Inlet drop on left culvert with some debris accumulation. Fix recommendation is add substrate in one of the culverts and install outlet weir.

546699

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	N. Fraser
Crossing ID#:	546722
PCIS Crossing ID:	
Date:	29/10/2011
Crew:	SM / JC
UTM:	10.538874.5447231
Stream:	York Cr
Road:	#27253 96 Ave
Road Tenure:	4782333
Stream Information	
Channel Width:	4.8 m
Stream Slope:	4 %
Beaver Activity:	No
Fish Sighted:	Yes
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	1.9 m x 11 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	1 m
Outlet Drop:	0.65 m
Outlet Pool Depth:	1 m
Inlet Drop:	No
Culvert Slope:	1 %
Barrier Result:	Barrier
Culvert Fix:	Open Bottom Structure
Fix Span / Diameter:	1.80

Comments:

Round culvert with concrete bottom and baffles. Was installed 2-3 years ago (pers com neighbour). Outlet drop is a barrier. 1 Chum observed downstream of culvert. Candidate for outlet structures particularly a stepped outlet to enhance fish passage. Not only backwatered but outlet step-drops installed and maintained. Remedial works require RP Bio and P. Eng working together.

546722

Upstream View

Downstream View

Inlet

Outlet

Barrel

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	N. Fraser
Crossing ID#:	546738
PCIS Crossing ID:	
Date:	14/11/2011
Crew:	SM / JC
UTM:	10.539351.5446972
Stream:	Whonnock Cr
Road:	Lougheed Hwy
Road Tenure:	4875225
Stream Information	
Channel Width:	6.4 m
Stream Slope:	3 %
Beaver Activity:	No
Fish Sighted:	Yes
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Oval Culvert
Culvert Dimensions:	3.9 m x 25 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	3 m
Outlet Drop:	0 m
Outlet Pool Depth:	1 m
Inlet Drop:	Yes
Culvert Slope:	2 %
Barrier Result:	Barrier
Culvert Fix:	Additional Substrate Material
Fix Span / Diameter:	

Comments:

Excellent habitat upstream, pools, abundant gravel for spawning. Chum dead upstream and downstream of culvert. Fish ladder on railway crossing. Measurements taken upstream. Candidate for fish passage structures installed into haunches, jointly designed by P. Eng and RP Bio.

546738

Upstream View

Downstream View

Inlet

Not Available

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	N. Fraser
Crossing ID#:	546882
PCIS Crossing ID:	
Date:	18/11/2011
Crew:	DFK / JC
UTM:	10.543647.5445163
Stream:	Trib to Fraser River
Road:	McLean St.
Road Tenure:	3608129

Stream Information	
Channel Width:	1.9 m
Stream Slope:	7 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Concrete Box
Culvert Dimensions:	2.4 m x 32 m
Continuous Embeddedment:	Yes
Average Depth Embedded:	0.25
Resemble Channel:	Yes
Backwatered:	No
Percent Backwatered:	
Fill Depth:	2.5 m
Outlet Drop:	0.04 m
Outlet Pool Depth:	0.03 m
Inlet Drop:	No
Culvert Slope:	3 %
Barrier Result:	Barrier
Culvert Fix:	Backwater
Fix Span / Diameter:	

Comments:

Good gravels, pools, overhanging vegetation, large woody debris. (CV 414 on card and photo) Outlet control rockwork appears to be eroded or shifted. Candidate for outlet control works to a Q100 standard.

546882

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

Closed Bottomed Structures Field Measurement Form

Location and Overview Data	
Watershed:	Pitt
Crossing ID#:	CV8
PCIS Crossing ID:	
Date:	29/10/2011
Crew:	AI / JC
UTM:	10.523023.5463562
Stream:	Trib to Pitt River
Road:	Quarry Road
Road Tenure:	Urban

Stream Information	
Channel Width:	2.7 m
Stream Slope:	8 %
Beaver Activity:	No
Fish Sighted:	No
Valley Fill:	Deep Fill
Habitat Value:	High

Culvert Measurements	
Crossing Type:	Closed Bottom Structure
Crossing Sub Type:	Round Culvert
Culvert Dimensions:	0.6 m x 8 m
Continuous Embeddedment:	No
Average Depth Embedded:	
Resemble Channel:	No
Backwatered:	No
Percent Backwatered:	
Fill Depth:	0.7 m
Outlet Drop:	0.77 m
Outlet Pool Depth:	0.65 m
Inlet Drop:	Yes
Culvert Slope:	2.5 %
Barrier Result:	Barrier
Culvert Fix:	Open Bottom Structure
Fix Span / Diameter:	1.20

Comments:

Abundant gravels suitable for CO, CT DV spawning. Abundant LWD, deeply undercut banks and overhanging vegetation for cover. Particularly during higher flow period. Fair to good habitat for spawning and rearing. CO downstream. Concrete culvert. Candidate for open bottom arch.

CV8

Upstream View

Downstream View

Inlet

Outlet

Barrel

Road

APPENDIX 5

Summary Table of Low Priority Crossings

ID	Stream Name	UTM (10U)	Barrier Result	Habitat Value	Cost Benefit (km/$K)	HGI	Fix	Cost Est. ($K)	Species Present	Barrier d/s	Barrier u/s	Comments
546750	Donatelli Brook	544238 5446609	Potential	Low	0.110	2.75	EM/BW	25		546772	Yes	Poor habitat upstream, little spawning habitat. Stream follows road and goes under two private drives with culverts. Fish presence unknown.
544996	Trib to Alouette R	535971 5456792	Barrier	Low	0.087	1.30	EM/BW	15		CV4		Beaver pond upstream. May be a candidate for outlet weir and baffles even though structure is not installed level.
546553	Trib to Kanaka Ck	532516 5450016	Barrier	Low	0.058	1.15	BW	20			Yes	Confined channel and clay/silt steep banks, high turbidity. Channel substrate all fines. Entire culvert structure heavily sagging. Downstream area choked with blackberry and ivy.
546225	N. Millionaire Ck	532132 5454178	Barrier	Medium	0.043	5.30	CB	124	CT	546241		Steep gradient downstream to 546241 may prevent access, good habitat present upstream at 545983.
546248	Trib to Hayward Res	544065 5453400	Potential	Low	0.034	0.55	EM/BW	16	CT	546412		Poor habitat, few pools, LWD and undercut banks present. Gravels present for spawning. Seasonally dewaters (pers. Com residents).
546400	Trib to Alouette R	528615 5452849	Barrier	Low	0.026	1.04	EM/BW	40	CO,CT, RB			Small stream with some deep pools, gravels, undercut banks and overhanging vegetation. Clay channel downstream. 1m lock block retaining wall barrier located 50 m upstream of crossing. Stormwater inputs into culvert.
CV1	Trib to Stave Lake	545775 5453932	Barrier	Low	0.024	0.69	OBS	29		546197		Poor habitat. Backwatered downstream for ~30 m on private land. Potential barrier on private road below.
546846	Jamieson Ck.	544011 5445269	Barrier	Low	0.023	2.10	OBS	90		546859		Channelized by residential yards. Poor habitat with low complexity. Riparian vegetation removed downstream. Some gravels and undercut banks present.
546383	Balabanian Ck	530332 5452894	Barrier	Low	0.022	1.31	EM/BW	60	CO,CT, RB			Small drop at inlet but likely passable. Small fish observed in outlet pool. Pool at inlet. Grate in front of inlet. Slope armoured. Candidate for backwatering and installation of concrete fastened baffles with substrate additions.
CV4	Trib to Alouette R	535289 5456452	Barrier	Low	0.020	1.22	CB	61			Yes	Perched culvert with L-shaped intake (facing up). Upstream is diverted step-pool boulder habitat (546043 along the road.
546043	Trib to Alouette R	535270 5456376	Barrier	Low	0.020	1.22	CB	61	CT,EB	CV4	Yes	Wooden weir/ladder structure located immediately below culvert. Series of steps to steep culvert suggests enhancement. Little water at time of survey. Stream is diverted upstream and runs ~200 m along the side of the ditch.
545808	Trib to Hoy Ck	514227 5461370	Barrier	High	0.019	0.14	RM	8		545827	Yes	Good habitat. Small stream with abundant overhanging vegetation, undercut banks, small pools and gravels present. Many culverts crossings downstream, with steep gradients.
545946	Trib to Alouette R	536645 5458311	Barrier	Low	0.018	0.67	CB	38				Fair habitat. Some gravel, overhanging vegetation and undercut banks. Fix with a low profile 2M span concrete panel on sill.
546525	Trib to Hayward Res	542642 5450037	Barrier	Low	0.017	1.43	CB	83		546524	Yes	Very long culvert under golf course green. Difficult to determine slope or backwater. Many barriers downstream. Ponds and wetlands upstream along fairway. Fish observed at outlet.

ID	Stream Name	UTM (10U)	Barrier Result	Habitat Value	Cost Benefit (km/$K)	HGI	Fix	Cost Est. ($K)	Species Present	Barrier d/s	Barrier u/s	Comments
546436	Trib to Steelhead Ck	549967 5451589	Barrier	Low	0.016	0.58	CB	37		546334		Small pools and gravels present. Access road to Davies Sand and Gravel Pit 2. Culvert starting to collapse.
544806	Tributary to Lost Ck	555445 5466229	Barrier	Medium	0.015	0.91	CB	61	RB			Larger stream with abundant gravels, undercut banks. Large woody debris, deep pool and boulder cover abundant. Average stream gradient 20% and resident RB present.
545927	Trib to Alouette R	535642 5458840	Barrier	Low	0.013	1.50	CB	114				Baffled culvert installed but outlet drop 2.5 m. High gradient upstream 16 %. Candidate for concrete bridge.
546575	Trib to Hairsine CK	546387 5448835	Barrier	Medium	0.013	1.28	OBS	101				Habitat appears ok but no access due to private property. Erosion due to road runoff on d/s side.
CV408	Trib to Hoy Ck	514249 5461507	Barrier	Low	0.012	0.30	OBS	25		545799		Low vegetation cover for 100 m then taller above. Rearing habitat on somewhat of a plateau. Multiple barriers downstream.
546373	Trib to Steelhead Ck	550298 5452122	Barrier	Low	0.011	1.42	SS	127		546334		Pond created by wood across top of culvert. Weir u/s above pond. Stream assessed at upstream crossings. Small but would provide some rearing habitat. Lots of sediment input upstream due to fill adjacent to channel.
314	Trib to Draper Ck	552282 5446802	Barrier	Medium	0.011	1.30	OBS	124				Moderate habitat upstream, low gradient with extensive overstream cover. Fish presence unknown.
546615	Currie Ck	552207 5448059	Barrier	Medium	0.010	1.22	CB	118	CT	546643		Resident report fish downstream. Small stream, but moderate habitat. Candidate for concrete panel bridge.
545822	Trib to Coquitlam R	516372 5460962	Barrier	Medium	0.010	0.25	BW	25				Moderate rearing habitat. Overhanging vegetation for cover. Candidate for outlet weir and internal implements. Embedment difficult due to length of structure.
546583	Thompson Ck	542749 5448877	Potential	High	0.009	1.55	CB	165	CM			Fish passage provided to culvert. Stream "manicured" u/s in private land, and includes some fish passage structures. Chum observed below.
546122	Trib to Lagace Ck	556372 5454317	Barrier	Low	0.009	0.19	EM/BW	20				Limited habitat upstream.
545702	Trib to Coquitlam	516435 5463399	Barrier	Medium	0.009	3.30	OBS	362				Habitat is large cobbles/boulders with all interstitial spaces filled with fines. Limited gravels.
546076	MacNab Ck	557004 5455041	Barrier	Low	0.009	0.65	CB	72				Stream dries up regularly, but should be passable at high water.
546184	Trib to Cardinalis	550645 5453748	Barrier	Low	0.009	0.60	OBS	69		545016		Culverts on driveway downstream which creates pond. Wetland backs up almost to culvert. Limited flows and habitat. Fish presence not confirmed.
546555	Shady Ck	531877 5449996	Barrier	Medium	0.009	0.52	EM/BW	60	CO,TR		Yes	Fish ladder at the outlet suitable for salmonids but barrier for small fish. Culvert likely not passable regardless. Inlet drop caused by accumulating leaves against grate. High turbidity. Structure is normally considered too small for remedial streambed structures inside pipe but this one may be considered for treatment due to cost of replacement.
546067	Trib to Spring Ck	530776 5456301	Barrier	Medium	0.008	1.63	OBS	198		546086		Moderate habitat. Fish presence unknown. Road is a compression curve on a tight horizontal corner, very poor location for a bridge. Candidate for open bottom arch.

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545950	Hyde Ck	517539 5459089	Barrier	High	0.008	2.52	CB	319	ACT,CC,CCT,CM,CO,CT,L,ST,TR,TSB			Excellent habitat. Low gradient gravels upstream. Stream bed is paved for 5 m after outlet of concrete box. This apron drops at slope of 50% for 2 m creating small cascade. May be passable to adults.
546745	Trib to Silverman Lake	545030 5446623	Barrier	Low	0.008	1.08	OBS	140		546750		Small stream, limited habitat. Numerous crossings downstream also barriers. Fish presence not confirmed.
546263	Hoyer Brook	549177 5453023	Barrier	Medium	0.006	0.29	CB	45	CT,RB	546270	Yes	Private driveway. Large pond u/s of culvert, created by culvert and driveway.
546732	Draper Ck	552603 5446499	Barrier	High	0.006	0.92	OBS	143	CT			High value low gradient habitat upstream. Evidence of outlet erosion, concrete filled sandbags placed with issues. Concrete bags of a similar age as structure #314 upstream indicative of a previous event. Replace with open bottom arch, natural streambed with concrete-free fish friendly rip rap.
546580	Trib to Whonnock Ck	539524 5449050	Barrier	Low	0.006	0.19	EM/BW	30		546590		Modified habitat upstream with pond and 1 m drop level control for pond 5 m upstream of culvert. Fish presence unknown.
546740	York Ck	539115 5446969	Barrier	High	0.006	0.38	EM/BW	60	CM,CO, CT		Yes	Excellent, complex habitat, abundant gravel and cover. Measurements taken upstream. Chum observed upstream and downstream of culvert. Candidate for backwatering and substrate installation with internal structures along haunches to be installed.
546303	Phillips Ck	543147 5452878	Potential	High	0.006	0.69	OBS	114	CT	546427	Yes	MoE sensitive fish habitat sign. Trash rack at u/s end creates inlet drop. Excellent spawning habitat. Cutthroat reported upstream.
546089	Trib to Lagace Ck	556367 5454815	Barrier	Medium	0.006	0.88	OBS	146				Moderate habitat. Inlet not visible, blocked by debris. Turbid water, high organics u/s. Culvert undersized.
546257	Brown Ck	547738 5453129	Barrier	High	0.006	2.93	OBS	493	CT			Steep gradients about 300 m downstream. Cutthroat reported upstream. Excellent habitat.
546222	Trib to Steelhead Ck	549205 5453490	Barrier	Medium	0.006	1.01	CB	179		546243		Nice habitat, gravels present. Barrier downstream on Dwedney Trunk. 6m low-profile concrete panel type bridge on low sills. Open streambed under. Compression curve will require fill and re-pavement, narrow road 5M wide, 20M disturbed.
546753	Trib to Fraser River	535995 5446961	Barrier	Low	0.006	0.69	OBS	123		546767		Low to moderate habitat. Abundant fines, compacted gravel, little deep pools, abundant overstream vegetation. Open bottom structure candidate with added costing for outlet control. Crossing is at a reach change from low gradient to steeper gradient.
546242	Trib to Alouette	527489 5454253	Barrier	Medium	0.005	0.76	SB	142	CC,CO, CT,L,SB		Yes	Chum sited upstream ~ 20 m. Chum observed spawning in mainstem. Stream is ditch of 216 Ave and storm drain. Candidate for steel bridge.
CV25	Trib to Fraser	517311 5454313	Potential	Low	0.005	0.42	EM/BW	80				Large ditch/slough that runs along Route 7B originating from industrial area. Candidate for baffles and substrate addition installed in existing structure.
546591	York Ck	538334 5448878	Barrier	Medium	0.005	0.59	OBS	113	CM,CO, CT	546616		Moderate habitat, deep pools present, overstream vegetation, gravel present however compacted with fines. Inlet drop caused by large woody debris at inlet. Candidate for open bottom arch.

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546515	Trib to Kanaka Ck	541715 5450207	Barrier	Medium	0.005	1.15	OBS	227		546525		Nice habitat upstream. Not sure if stream connects to 546542, as no stream observed exiting block, only road ditches.
546780	Trib to Fraser River	535827 5446712	Barrier	Low	0.005	0.14	OBS	27			Yes	Limited habitat upstream. Railway crossing.
544898	Trib to Coquitlam R	516587 5465006	Barrier	High	0.005	0.82	CB	166				Excellent habitat. Large woody debris, gravels and pools present. Ditch line to Pipeline Road for 35 m. Candidate for concrete bridge.
546517	Trib to Kenworthy Ck	553370 5449687	Barrier	Low	0.005	0.26	OBS	57				Small fish observed at outlet. Weir on private property below culvert. Stream runs along the road to 546512.
546711	Trib to Silverman lake	545038 5447153	Barrier	Medium	0.004	0.68	OBS	155		546750		Almost dewatered at outlet pool crest. Small stream with moderate habitat upstream. Numerous downstream crossings. Fish presence not confirmed.
544872	Tributary to Lost Ck	554893 5465005	Barrier	Low	0.004	0.16	CB	37				Stream runs along ditch for 40m. Barrier where stream enters ditch. Poor habitat upstream. Gradient increases upstream.
CV113	Trib to Kanaka Ck	539091 5450472	Barrier	Medium	0.004	0.55	OBS	127				Wood culvert. Moderate habitat, LWD and overstream vegetation. Pond upstream of culvert. Drop at outlet due to riprap 0.8 m. Compression curve.
545487	Trib to Pitt River	525895 5469185	Barrier	Medium	0.004	0.15	CB	37				Fair habitat for spawning. Abundant gravels.
546643	Currie Ck	552709 5447661	Barrier	High	0.004	0.65	CB	175	CT		Yes	Two culverts present. Nice looking stream, good size and low gradient.
546522	Trib to Adrian Ck	542763 5450088	Barrier	Medium	0.004	0.83	OBS	230		546540		Lots of small gravels and small pools u/s.
546384	Trib to Balabanian Ck	530891 5452845	Barrier	Low	0.004	0.67	OBS	185				Low value habitat. Possibly passable, some habitat upstream. Wood culvert.
544999	Trib to Rolley Lake	544024 5456312	Barrier	Low	0.003	0.12	OBS	34				Poor habitat, no pools, low flows. Fish presence likely. Compression curve, poor bridge approach.
545016	Trib to Cardinalis	550761 5454121	Barrier	Medium	0.003	0.40	SS	118			Yes	Beaver dam immediately u/s. Fish presence not confirmed. Culvert likely undersized.
546526	Siegel Ck	532519 5450431	Barrier	Medium	0.003	0.38	OBS	113		CV401	Yes	Fine and small gravel substrate. Turbidity due to fine silt. Some wood and pools to 0.5 m deep.
545719	Trib to Alouette R	537862 5462244	Barrier	Medium	0.003	0.34	OBS	114				Excellent habitat for trout, undercut banks, LWD, deep pools and overhanging vegetation. Gravels also present for spawning.
545857	Trib to Hoy Ck	514253 5460692	Barrier	Medium	0.003	0.29	EM/BW	100			Yes	20% gradient upstream. Candidate for enhancement of existing baffles, addition of substrate and backwatering.
546540	Adrian Ck	543150 5449719	Barrier	Medium	0.003	0.68	OBS	241		546541	Yes	Fry observed upstream.
545677	Trib to Pitt River	522961 5463582	Barrier	Low	0.003	0.10	CB	37				Small stream with abundant gravels suitable for spawning. Few pools. Abundant undercut banks and overhanging vegetation.
CV109	Trib to Kanaka Ck	535524 5452874	Barrier	Low	0.003	0.58	OBS	207				Wooden culvert. Stream spreads out downstream, shallow water. Foam on water. Abundant overstream vegetation.

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546409	Trib to Kanaka Ck	532243 5452636	Barrier	High	0.003	2.15	OBS	772	CH,CM, CO,CT, RB			Low gradient stream above culvert. Some sediment at culvert.
546532	Trib to Kanaka Ck	530687 5450417	Barrier	Medium	0.003	0.72	OBS	264	CO,TR			Beaver dam upstream of culvert. Compression curve at corner intersection.
545021	Trib to Stave Lake	546347 5453915	Barrier	Low	0.003	0.49	SB	184			Yes	Steep gradients upstream, lower gradient downstream ~10 %. Realignment of approaches required.
546862	Jamieson Ck.	543748 5445119	Barrier	Low	0.003	0.07	BW	25		546882	Yes	Good habitat. Some undercut banks and deep pools. Candidate structure for a fish passage side and stormwater side.
546412	Trib to Hayward Res	544696 5452096	Barrier	Medium	0.003	1.82	OBS	701	CT		Yes	Moderate habitat with pools and abundant cover. Culvert undersized but no evidence of overtopping.
545724	Macintyre Ck	522243 5462730	Barrier	High	0.003	0.51	SB	202	CAS,CM ,CO,CT, DV,L			Washout at culverts. Dry with dead chum at outlet. Excellent habitat if watered. Abundant gravels, LWD, undercut banks, and overhanging vegetation. Likely redirected into Deimer Creek upstream (BR2).
545508	Trib to Pitt River	525636 5468154	Barrier	Medium	0.003	0.10	CB	40				Good habitat. Abundant deep pools, overhanging vegetation and undercut banks.
546697	Trib to Fraser River	532380 5447912	Barrier	Medium	0.002	4.43	OBS	1800	ACT,CM ,CO,CT		Yes	Abundant overstream vegetation. High turbidity. Could investigate to convert one of the pipes to fish passage structure, however length of structure and size likely preclude conversion to fish passage.
544595	Trib to Terepocki Ck	556300 5470872	Barrier	Low	0.002	0.09	CB	37				Poor habitat, dry channel.
546224	Trib to Kanaka Ck	535407 5454078	Barrier	High	0.002	0.59	CB	254		546351	Yes	Wooden culvert sagging in middle. Excellent habitat, Abundant deep pools, LWD, overstream vegetation and gravels.
546568	Trib to Kanaka Ck	533700 5449641	Barrier	Medium	0.002	0.22	CB	95	CO,CT		Yes	Higher gradient, turbid water. Moderate habitat with abundant cover overstream vegetation and boulder.
546118	Trib to Alouette R	533729 5455424	Barrier	Low	0.002	3.22	OBS	1422				Abundant cover, overhanging vegetation, undercut banks, LWD and some small pools.
546197	Trib to Stave Lake	545926 5453809	Barrier	Low	0.002	0.29	OBS	129		545021	Yes	Small stream. Poor habitat.
545500	Trib to Pitt River	525725 5468327	Barrier	High	0.002	0.08	CB	37				Excellent habitat. Abundant gravels, undercut banks and overhanging vegetation. Fry observed in gravels downstream.
545513	Trib to Pitt River	525645 5468089	Barrier	Low	0.002	0.09	CB	40				Poor habitat upstream. Drains through ditch for 100m then goes subsurface intermittently.
546590	Trib to Whonnock Ck	539592 5448848	Barrier	Medium	0.002	0.23	OBS	104		546738	Yes	Some moderate habitat with some pools and gravel. Bank recently fixed, erosion control mats observed.
CV112	Trib to Kanaka Ck	538728 5450014	Barrier	Medium	0.002	0.55	OBS	255				Moderate habitat present, shallow water in sections. Part of bank collapsed causing a barrier 0.85 m high. Compression curve.
546132	Trib to N. Alouette	530453 5455259	Barrier	Medium	0.002	0.41	CB	191				Good habitat. New culvert. Some channelization immediately upstream with riparian vegetation removed. Worker indicated the stream had been designated non-fish.

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546086	Trib to Spring Ck	530516 5455934	Barrier	Medium	0.002	0.49	OBS	238			Yes	Highly turbid downstream but clear upstream. Storm drain enters into Anderson Creek. Abundant gravels present with overhanging vegetation cover throughout. Debris on trashrack creating barrier 3cm.
545766	Trib to Coquitlam	516530 5462087	Barrier	Low	0.002	0.27	OBS	131				Limited flow. High turbidity. Heavily loaded with fines downstream.
546243	Trib to Steelhead Ck	549013 5453267	Barrier	Medium	0.002	0.32	CB	158			Yes	Good low gradient habitat below culvert. Gradient increases above. Current structure too small.
545002	Trib to Cardinalis	550751 5455226	Barrier	Medium	0.002	0.20	OBS	104	DV,RB			Wetlands downstream with beaver activity. Nice habitat u/s. Spawning gravels.
546859	Jamieson Ck.	543791 5445167	Barrier	Low	0.002	0.26	OBS	135		546862	Yes	Good habitat but fairly steep upstream (27 %). Boulders, undercut banks, gravels and overhanging vegetation present. Steep gradient downstream caused by road fill (~50% for ~40 m).
546756	Trib to Fraser River	534189 5446989	Barrier	Medium	0.002	3.36	OBS	1800		546756 A	Yes	Good habitat upstream with low gradients, abundant cover, overstream vegetation, large woody debris. Abundant gravel for spawning.
546402	W Ck	527837 5452856	Barrier	Low	0.002	0.86	OBS	477	CC,CO, CT,L,SB	546350		Stormwater inputs into culvert. Small stream.
546541	Adrian Ck	543201 5449672	Barrier	Medium	0.002	0.07	CB	40			Yes	Wood cribbing along shore represent barriers at some flows/reservoir elevations.
544865	Tributary to Lost Ck	554967 5465088	Barrier	Medium	0.002	0.10	CB	56		544864		Gradient increases upstream. Good habitat.
544864	Tributary to Lost Ck	554875 5465096	Barrier	Medium	0.002	0.09	CB	56			Yes	Good habitat. Abundant gravels, large woody debris, deep pools, undercut banks and overhanging vegetation.
544958	Trib to Davis Ck	556163 5459521	Barrier	Low	0.002	0.17	SB	103				Poor habitat.
CV401	Trib to Siegel Ck	532506 5450445	Barrier	Low	0.001	0.38	OBS	268		546553	Yes	Limited gravels, some pools to .5 m deep. Primarily fines in substrate. Significant turbidity. Compression curve.
546616	York Ck	538730 5448610	Barrier	Medium	0.001	0.49	OBS	360	CM,CO, CT	546722	Yes	Excellent habitat downstream, pools present with overstream vegetation. Upstream little pool with some gravel present.
546570	Trib to Kanaka Ck	533908 5449583	Barrier	Low	0.001	0.74	CB	593	CO,CT	546568		Abundant instream vegetation upstream. Habitat excellent downstream with cover consisting mainly of boulder, deep pools, overstream vegetation.
546168	Trib to Kanaka Ck	535532 5454384	Barrier	Medium	0.001	0.22	OBS	189		546224		Small fish observed upstream of culvert. Moderate habitat, shallower than downstream, abundant overstream vegetation. Substrate mostly fines.
546510	Siegel Ck	532772 5450684	Barrier	Medium	0.001	0.54	OBS	458		546526		Some good gravels, pools and wood. Pools to 0.5 m deep.
546458	Trib to Dunlop Ck	534230 5451921	Barrier	Medium	0.001	0.08	EM/BW	70	CM,CO, CT			Some gravels, pools present. High turbidity but good riparian vegetation. Clays present on banks, could cause turbidity. Could benefit from outlet weir works and inlet step-down.
546527	Trib to Kanaka Ck	532083 5450431	Barrier	Low	0.001	0.42	OBS	369	CO,TR	546555		Concrete culvert. Habitat better downstream than upstream. Narrow channel upstream with abundant instream vegetation. Blind horizontal corner and compression curve.

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546408	Trib to Hayward Res	544987 5452097	Barrier	Low	0.001	0.25	OBS	223				Poor habitat. Structure too small for Q100 rating.
546495	Trib to Fraser R	526806 5451395	Barrier	Low	0.001	0.68	OBS	654	CO			Culvert crosses Lougheed highway into hospital area.
546682	Trib to Fraser R	535193 5448022	Barrier	Medium	0.001	0.30	OBS	294		546756		Wetland downstream.
546756A	Trib to Fraser River	534189 5446979	Barrier	Medium	0.001	0.05	EM/BW	50			Yes	Concrete box culvert under railway ~ 5m downstream of 546756. Candidate for adding substrate material and outlet weir for backwatering.
546290	Trib to Alouette	527491 5453659	Barrier	Low	0.001	0.45	CB	451	CC,CO, CT,L,SB	546242	Yes	Local resident reports fish upstream up to 6 ". Gravels upstream in ditch.
546356	Baker Ck	516574 5453671	Barrier	Medium	0.001	0.34	OBS	371	CM,CO, CT,RB	546405		Good habitat. Overhanging vegetation and undercut banks throughout. Concrete apron for 2 m at outlet. Gravels downstream.
545956	Trib to Alouette R	536582 5458148	Barrier	Low	0.001	0.10	SB	113				Poor habitat. Little complexity upstream with steep gradients after ~100m. Habitat structures and high density salmon spawning in the Alouette adjacent to the culvert.
546396	Trib to Kanaka Ck	535117 5452590	Barrier	High	0.001	0.46	CB	532			Yes	Excellent habitat, low gradient, abundant cover overstream vegetation and deep pools. Gravel present for spawning. Log 3 m downstream of outlet causing 0.65 m drop which could be a barrier.
546350	W Ck	527757 5453221	Barrier	Medium	0.001	0.39	OBS	458	CC,CO, CT,L,SB	546290	Yes	Abundant overhanging vegetation and undercut banks for cover. Habitat assessment should be conducted to identify if spawning gravels are available.
545647	Viking Ck	539006 5463516	Barrier	Medium	0.001	0.22	SB	274	CT,RB	545649	Yes	Some pools present but relatively low complexity. Cover mostly boulder with little overhanging vegetation and LWD.
546685	Trib to Fraser R	534094 5448018	Barrier	Medium	0.001	0.32	CB	408	ACT,CM ,CO,CT	546697		Bank failure downstream of culvert down to clay. 3 m drop at outlet. Low to moderate habitat, little pools, 6% gradient upstream.
545547	Trib to Pitt River	525464 5467446	Barrier	Medium	0.001	0.05	CB	61				Fair habitat. Some deep pools and boulder cover available. Channel segments composed of bedrock upstream.
545649	Viking Ck	539150 5463467	Barrier	Medium	0.001	0.16	SB	239	CT,RB		Yes	Moderate habitat. High disturbance due to debris flow. .
545948	Watkins Ck	518014 5459083	Barrier	High	0.001	0.35	SB	546				Good habitat. Gravels present. Some pool, boulder and overhanging vegetation for cover available. Only 2 cm of flow in structure.
546380	Trib to Hayward Res	545464 5452290	Barrier	Low	0.001	0.30	OBS	555		546449		Old wooden round culvert. Stave pipe in good condition, likely 25 years lifespan. Culvert severely undersized.
545650	Viking Ck	538791 5463494	Barrier	Medium	0.001	0.12	SB	239	CT,RB	545647		Good rearing habitat. Pools present with boulder cover. Little gravel present. Perched culvert, little overhanging vegetation.
CV111	Trib to Kanaka Ck	535498 5452765	Barrier	Medium	0	0.12	OBS	294			Yes	Moderate habitat due to confinement by road riprap. Habitat improves downstream.
546524	Adrian Ck	542646 5450042	Potential	Low	0	0.01	BW	25		546540	Yes	Low habitat only as 546525 immediately u/s . Fry above culvert.

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546241	N. Millionaire Ck	532116 5454053	Barrier	Medium	0	0.14	CB	355	CT, (ST)		Yes	Narrow channel with little fish habitat. Gradient 20 % downstream of culvert. Barrier for size of creek. Local resident says stream has dropped substantially in storm flows from storm drain diversion of subdivision upstream.
546767	Trib to Fraser R	535870 5446834	Barrier	Low	0	0.18	OBS	594		546780	Yes	Concrete culvert.
546772	Donatelli Brook	543436 5446450	Barrier	Low	0	0.03	OBS	177			Yes	Small stream. Limited habitat, few pools or gravels.
CV102	Trib to Stave Lake	548958 5462005	Barrier	Low	0	0.01	OBS	34				Gradient 28 % ~10 m upstream culvert. One small fish observed. Stream not on trim map.
545827	Trib to Hoy Ck	514196 5461206	Barrier	Medium	0	0.17	CB	610		545832	Yes	Good complexity, substrate material, pools and overhanging vegetation. Steep gradient. 1.2 m high cascade immediately upstream.
546482	Trib to Kanaka Ck	532259 5451557	Barrier	Low	0	0.22	OBS	998	CO,TR			Small stream but suitable gravels present. Some pools, wood and dam/plunge structure.
545844	Trib to Hoy Ck	514187 5460960	Barrier	Medium	0	0.15	CB	707		545857	Yes	Steep gradients. Good complexity with pools, cascades and large woody debris.
545832	Trib to Hoy Ck	514190 5461108	Barrier	Medium	0	0.10	CB	610		545844	Yes	Good spawning substrate. Pools and small cascades. overhanging vegetation.
546278	Trib to Coquitlam	513807 5454371	Barrier	High	0	0.10	OBS	845				Excellent habitat. Abundant gravels and overhanging vegetation. Double culvert. Larger oval structure has a blocked inlet. Chum observed upstream.
546485	McKenny Ck	526051 5451706	Barrier	Medium	0	0.10	OBS	887	ACT,CC ,CM,CO, CT,L,PK ,RB,SB	546478		Storm sewers empty into culvert. Moderate habitat. Single culvert on upstream, double culvert on downstream. River left CV may be storm drain only.
546514	Trib to Fraser R	529497 5450763	Barrier	Medium	0	0.23	OBS	2126			Yes	Abundant overstream vegetation, mostly blackberry bushes.
546504	Trib to Fraser R	529587 5450967	Barrier	Low	0	0.51	OBS	5000		546514		Concrete culvert. Could not access outlet, fenced off. Culvert under condominiums.
545799	Trib to Hoy Cr	514269 5461506	Barrier	Medium	0	0.02	CB	1497		545808	Yes	Culvert 20 m upstream. Good complexity. Pools, cascades overhanging vegetation.
544916	Trib to Davis Lake	554784 5462081	Barrier	Low	0	0	OBS	43				Pond upstream of culvert. Inlet blocked with debris. Downstream channel at outflow disconnected from wetland complex downstream. Extensive beaver control required.
545006	Trib to Kanaka Ck	539890 5455514	Barrier	Medium	0	0	SB	10		546433		Moderate habitat. Fish presence unlikely due to steep gradients downstream. Inlet blocked by large woody debris.
545998	Trib to Scott Ck	513754 5458346	Barrier	Medium	0	0	OBS	1000				Culvert 210 m long. Inlet is 15 m from next culvert. Under Barnet highway and shopping mall.
CV402	Trib to Dunlop Ck	532897 5450431	Barrier	Low	0	0	OBS	598				Fine substrate with occasional pools 0.2 m deep.
CV404	Trib to Coquitlam	516429 5461502	Barrier	Low	0	0	OBS	172				Ditchline running into Coquitlam River. Need to separate and sump storm drain to creek to provide for urban runoff control to fish.
CV406	Trib to Hoy Ck	514147 5460822	Barrier	Low	0	0	CB	707				Steep gradients. Some gravels and cobbles upstream between lock block bounded fills. Overhanging vegetation. Disturbed with lots of angular rock present.
CV407	Trib to Hoy Ck	514128 5460864	Barrier	Low	0	0	CB	707				Highly disturbed. Low flows and steep gradients.

ID	Stream Name	UTM (10U)	Barrier Result	Habitat Value	Cost Benefit (km/$K)	HGI	Fix	Cost Est. ($K)	Species Present	Barrier d/s	Barrier u/s	Comments
CV409	Trib to Scott Ck	513742 5458231	Barrier	Medium	0	0	OBS	1000				Deep pools present. High velocity in ditch line upstream.
CV6	Trib to Alouette R	537802 5459755	Barrier	Low	0	0	CB	38				Some gravels suitable for spawning. Overhanging vegetation and undercut banks present.
CV7	Trib to Alouette R	537506 5459381	Barrier	Low	0	0	CB	38				Moderate amounts of gravels present. Some undercut banks with few deep pools. Abundant overhanging vegetation.
CV9	S. Macintyre Ck	521941 5462475	Barrier	Medium	0	0	OBS	57				Abundant small and large gravels present. Abundant SWD and overhanging vegetation for cover. Shallow pools abundant.

APPENDIX 5

Summary Table of Crossings Requiring No Further Assessment

ID	Road Type	Watershed	Stream Name	UTM/GPS Grid (10)	Barrier Result	Habitat Value	Fix	Comments
303	Urban	Stave	Hairsine Ck	547889 5447291	Potential	High	No fix	Passable.
304	Rural	Stave	Trib to Silverman LK	543478 5446466	Barrier	Low	No fix	Very poor habitat u/s.
305	Rural	Stave	Trib to Silverman LK	544226 5447274	Barrier	Low	No fix	Very poor habitat upstream.
308	Urban	Stave	Stave R	543163 5449419	Barrier	High	No fix	Hayward Dam. Excellent habitat upstream.
544804	Unknown	Lost	Tributary to Lost Ck	557469 5466159	Barrier	Low	No fix	Steep gradients upstream and downstream.
544805	Unknown	Lost	Tributary to Lost Creek	555445 5466229	Potential	Low	No fix	Very poor habitat.
544809	Unknown	Lost	Tributary to Lost Creek	556581 5466153	Barrier	Low	No fix	Steep gradients downstream and upstream.
544831	RP	Lost	Tributary to Lost Creek	555702 5465698	Barrier	Low	No fix	Steep gradients downstream (30%).
544914	Forest	Stave	Trib to Sayres Lk	548417 5462695	Barrier	Low	No fix	No HGI.
544981	RP	Stave	Trib to Seventynine Cr	543313 5458127	Barrier	Low	No fix	Steep gradients.
544991	RP	Stave	Trib to Cardinalis Cr	551107 5456931	Barrier	Low	No fix	No HGI. Steep gradients.
545007	RP	Stave	Brown Ck	548442 5455100	Barrier	Low	No fix	Steep gradients below culvert.
545014	RP	Stave	Brown Ck	548398 5454584	Barrier	Medium	No fix	Steep gradients.
545028	RP	Stave	Trib to Steelhead Ck	551962 5451284	Barrier	Low	No fix	Waterfall immediately upstream.
545617	Unknown	Widgeon	Trib to Pitt R	524597 5465082	Barrier	Low	No fix	Ephemeral stream that drains ditch and two steep gullies. No HGI.
545653	Urban	Coquitlam	Trib to Coquitlam R	516564 5464252	Barrier	Low	No fix	Culvert is situated at location of natural barrier (>5m).
545668	Urban	Coquitlam	Trib to Coquitlam R	516407 5463989	Potential	Low	No fix	No further assessment due to very low HGI (75m).
545681	Park	Alouette	Trib to Alouette R	538187 5462777	Barrier	Low	No fix	Very poor habitat.
545730	Urban	Coquitlam	Trib to Coquitlam R	516547 5462873	Potential	Low	No fix	Gravel pit immediately upstream. No HGI.
545778	Urban	Pitt	Sturgeon Sl	525854 5461366	Potential	Low	No fix	Mechanically controlled double culvert. No HGI.
545793	Urban	Coquitlam	Hoy Ck	515393 5461554	Barrier	High	No fix	Passable structure.
545820	Urban	Coquitlam	Trib to Coquitlam	516380 5461044	Potential	Low	No fix	Very poor habitat.
545824	Urban	Coquitlam	Trib to Coquitlam R	516303 5460739	Potential	Medium	No fix	Ephemeral stream. Dry at time of survey.
545884	Urban	Pitt	Smiling Cr	518434 5460270	Barrier	Medium	No fix	New passable baffled structure.
545939	Urban	Pitt	Watkins Cr	517798 5459250	Potential	High	No fix	New passable structure. Completely embedded.
545952	Urban	Coquitlam	Scott Cr	513684 5459229	Barrier	High	No fix	Passable because structure is fully embedded.
545964	Urban	Coquitlam	Scott Cr	513681 5459017	Barrier	High	No fix	Passable.
545969	Urban	Coquitlam	Trib to Hoy Cr	514073 5458906	Potential	Medium	No fix	No HGI.
545985	Urban	Cascade	Trib to Cascade Cr	556511 5456857	Potential	Low	No fix	Goes subsurface.
545994	Urban	Coquitlam	Scott Cr	513942 5458392	Potential	High	No fix	Passable.
545997	Urban	Coquitlam	Hoy Cr	514221 5458346	Barrier	High	No fix	Passable due to baffles.
546109	Urban	Lagace	Trib to Belcharton Cr	554775 5454651	Potential	Low	No fix	Passable.
546155	Unknown	Lagace	Lagace Ck	556857 5453842	Potential	High	No fix	Passable.

ID	Road Type	Watershed	Stream Name	UTM/GPS Grid (10)	Barrier Result	Habitat Value	Fix	Comments
546173	Urban	Lagace	Lagace Ck	556791 5453765	Potential	High	No fix	Passable.
546178	Urban	N. Alouette	Trib to N. Alouette R	530868 5454677	Potential	High	No fix	Passable.
546205	Ind.	Katzie	Cranberry Sl	520020 5454920	Potential	Low	No fix	Habitat marginal with low to no flow. Perched culvert, highly modified.
546208	Urban	Katzie	Cranberry Sl	520090 5454850	Barrier	Low	No fix	Drainage ditch culvert for Pitt River bridge. No HGI.
546254	Urban	Stave	Trib to Steelhead Ck	548753 5453149	Potential	High	No fix	Passable.
546285	Rural	Stave	Trib to Steelhead Ck	550977 5452750	Potential	Low	No fix	Very poor habitat upstream. Many barriers downstream (driveways).
546309	Urban	Alouette	Trib to Alouette R	528925 5453400	Potential	Low	No fix	No HGI. Fed by groundwater.
546319	Urban	Lagace	Belcherton Ck	554824 5452216	Potential	High	No fix	Twin culverts passable.
546338	Urban	Lagace	Belcherton Ck	554797 5452128	Potential	High	No fix	Triple culverts, passable.
546345	Urban	Alouette	Legion Cr	529224 5453190	Barrier	Low	No fix	Outflow on private property. No access.
546357	Urban	Lagace	Oru Ck	554793 5452037	Potential	High	No fix	Passable.
546381	Urban	Stave	Trib to Hayward Res	544337 5452308	Potential	High	No fix	Passable.
546393	Urban	Alouette	Latimer Cr	533048 5452703	Potential	Low	No fix	No HGI.
546395	Urban	Alouette	Legion Cr	529303 5452846	Barrier	Low	No fix	Very poor habitat. High disturbance, low flows.
546397	Urban	Alouette	Trib to Alouette R	529075 5452838	Barrier	Low	No fix	Outflow location unknown. Muddy substrate, poor habitat, low flows.
546398	Urban	Alouette	Trib to Alouette R	528942 5452848	Barrier	Low	No fix	Stream goes subsurface downstream.
546405	Urban	Pitt	Baker Cr	516628 5453318	Barrier	High	No fix	Structure is passable as it is completely embedded.
546426	Urban	N. Fraser	Whonnock Cr	541199 5452055	Barrier	High	No fix	Passable.
546451	Urban	Stave	Trib to Hayward Res	545121 5451556	Barrier	Low	No fix	Steep gradients. Very poor habitat.
546483	Recreational	Stave	Trib to Hayward Res	545512 5450975	Barrier	Low	No fix	Poor habitat, limited flows and few pools.
546488	Urban	Kanaka	McFadden Cr	536516 5451419	Potential	High	No fix	Passable.
546497	Urban	Hatzic	Trib to Hatzic Sl	556108 5449976	Barrier	Low	No fix	2m falls 10 m downstream of culvert.
546505	Unknown	Stave	Trib to Adrian Ck	542895 5450377	Barrier	Medium	No fix	Steep gradient below culvert (>20%).
546519	Urban	Kanaka	Dunlop Cr	533394 5450582	Potential	High	No fix	Passable.
546530	Urban	N. Fraser	Trib to Whonnock Cr	541613 5449960	Potential	Low	No fix	Passable.
546539	Urban	Kanaka	Trib to Kanaka Cr	531627 5450239	Potential	Medium	No fix	Concrete box culvert with baffles. Passable.
546550	Urban	N. Fraser	Trib to Whonnock Cr	541618 5449669	Potential	Low	No fix	Very low habitat quality upstream.
546576	Urban	Kanaka	Trib to Kanaka Cr	533576 5449382	Barrier	Low	No fix	No HGI.
546584	Urban	Kanaka	Trib to Kanaka Cr	533077 5449281	Potential	Low	No fix	Low habitat value. Sections with no defined channel.
546587	Urban	Hatzic	Trib to Hatzic Sl	554820 5448293	Potential	High	No fix	Passable. Piece of wood at inlet could be removed.
546599	Urban	Kanaka	Spencer Cr	531368 5449069	Potential	Medium	No fix	Agricultural ditch. Very poor habitat. Multiple fenced crossings upstream.
546602	Urban	Kanaka	Spencer Cr	532291 5449006	Potential	Medium	No fix	No HGI.

ID	Road Type	Watershed	Stream Name	UTM/GPS Grid (10)	Barrier Result	Habitat Value	Fix	Comments
546625	Urban	Kanaka	Spencer Cr	532191 5448823	Potential	Medium	No fix	Passable.
546654	Urban	Stave	Hairsine Cr	546974 5447536	Potential	High	No fix	Passable.
546661	Urban	Stave	Trib to Hairsine Cr	547385 5447680	Potential	Low	No fix	Passable.
546665	Urban	Hatzic	Trib to Chilqua Sl	556312 5447258	Barrier	Low	No fix	Low flows. Steep (>25%) upstream. CV on private land 100m downstream.
546680	Urban	N. Fraser	Trib to Fraser R	535372 5448023	Barrier	Low	No fix	No HGI.
546691	Urban	N. Fraser	York Cr	538927 5447716	Potential	High	No fix	Passable.
546728	Urban	Hatzic	Draper Ck	552277 5446566	Potential	Medium	No fix	Passable.
546734	Urban	Hatzic	Draper Ck	552199 5446497	Potential	Medium	No fix	Passable.
546758	Rural	Stave	Donatelli Brook	543860 5446794	Potential	Medium	No fix	Passable.
546764	Rural	Stave	Smith Brook	544852 5446489	Barrier	Low	No fix	Poor habitat. Steep gradients (20%) downstream.
546802	Urban	Hatzic	Draper Ck	553808 5445547	Barrier	Medium	No fix	Crossing installed on waterfall.
546817	Urban	Hatzic	Draper Ck	554552 5445298	Barrier	High	No fix	Baffles present in lower box. Allows passage of salmon.
545681B	Park	Alouette	Trib to Alouette R	538321 5462898	Barrier	Low	No fix	Two old plugged culverts. Dry channel, very low habitat value.
546530B	Urban	N. Fraser	Trib to Whonnock Cr	541609 5449926	Potential	Low	No fix	Likely passable. Diverted through private property, gated.
546666B	Urban	N. Fraser	Trib to Fraser R	533094 5448276	Barrier	Low	No fix	No HGI.
CBC101	Railway	N. Fraser	Trib to Fraser R	529497 5450753	Potential	Medium	No fix	Passable.
CV10	Urban	Pitt	Trib to Partington Cr	520364 5460659	Potential	Low	No fix	New culvert with inlet/outlet controls and baffles, passable.
CV11	Urban	Pitt	Trib to Partington Cr	520362 5460565	Potential	Medium	No fix	Passable. New baffled structure with outlet control.
CV110	Urban	Kanaka	Trib to Kanaka Cr	535508 5452800	Potential	Medium	No fix	Passable.
CV14	Rural	N. Alouette	Trib to N. Alouette R	528185 5456080	Barrier	Low	No fix	Irrigation ditch. Mechanically controlled inlet . No HGI.
CV20	Unknown	Widgeon	Trib to Pitt R	525900 5469202	Potential	Low	No fix	Ephemeral stream. Poor habitat. Passable.
CV3	Urban	Alouette	Trib to Alouette R	528929 5453341	Potential	Low	No fix	Ditch of Abernethey. No HGI.
CV33	Railway	N. Fraser	Jamieson Cr	543415 5445230	Potential	High	No fix	Passable.
CV403	Urban	Coquitlam	Trib to Coquitlam R	516748 5462450	Barrier	Low	No fix	Gravel pit immediately upstream. No HGI.
CV405	Urban	Coquitlam	Trib to Coquitlam R	516537 5462843	Barrier	Low	No fix	Gravel pit immediately upstream. No HGI.
CV5	Unknown	Alouette	Trib to Alouette R	535659 5457694	Potential	High	No fix	Access to coho spawning/rearing area. Beaver box in place. Passable.